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Journal of Electronic Networks, Devices and Fields

Aims and Scope

Journal of Electronic Networks, Devices and Fields is a journal that publishes original research papers in the fields of electronic networks, devices and fields. Journal of Electronic Networks, Devices and Fields is a new journal which publishes research papers in the areas of from electrical distribution networks to integrated circuits in VLSI design, and from static electric and magnetic fields through microwaves to optical design. Areas included (but not limited to) are information networks, analogue and digital circuits, power distribution, solid state devices, electronic tubes, electrical components, moving boundary problems, coupled problems, network modelling, energy and moment methods, element and ray methods, graphs, and pre- and post-processing of data.

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Contents

A Problems And Issues In Wireless Sensors Networks Existing In Efficiency Criteria

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A B S T R A C T

Network security refers to the protection of information and resources from loss, corruption, and improper use. With WLANs, security vulnerabilities fall within the following areas .

- *Passive monitoring*
- *Unauthorized access*
- *Denial-of-service attacks*

The limited capabilities of a sensor node, such as restricted processing capabilities and a limited amount of energy, have an impact on all the parameters of a WSN. Taking into account the energy characteristics of transmitters in sensor nodes and their high susceptibility to interference, the quality of communication between sensor nodes can vary significantly with time. That is why the information loss and substantial delays often occur in WSNs. And their impact is closely associated with the size of a WSN.

Keywords: WSNs, Task Monitoring.

1. INTRODUCTION

Also, in order to save energy, sensor nodes in most WSNs are in the low power state (the sleep mode) most of the time, as mentioned in Section 2.2. At the low power state, all the components of a sensor node except the microcontroller are switched off and inside the microcontroller only a small portion of internal blocks are switched on. Moreover, in most applications, the amount of calculations, performed by the microcontroller at a sensor node, is reduced to minimum. This technique allows to extend the WSN lifetime up to several months or even several years.

For a typical monitoring applications information losses and shortage of the processing capabilities are not crucial, because dropping of one or several measurements does not have a strong influence on the result of the processing of the data from the whole WSN. Tolerance to partial loss of information due to the low communication quality is the main difference between common WSN applications and WSN applications for critical tasks. The critical tasks here and later will reference to such applications where the data received from the WSN is used as basis for responsible decision-making. The exact criteria for determining whether task is critical or not, are out of scope of this technical paper. This we describe only the main peculiarities and give a few examples of critical tasks. Applications of WSNs for critical tasks in comparison with applications for common tasks have stronger reliability, information security and quality of service (QoS) requirements. Clauses 7.2, 7.3 and 7.4 describe some relevant applications of WSNs for critical tasks.

2 Security and privacy

Wireless media is much more vulnerable than wired media for attackers. In critical tasks information security problems are particularly important since a security breach can result in a variety of negative effects. WSN applications for critical tasks are required to support integrity and confidentiality of the data exchanged during the application operations. These applications are required to provide security of exchanged data against malicious attacks. It is recommended to provide a secure channel to protect the data flows.

Data encryption and authentication are common information security techniques used in WSNs [50]. Restriction of access to the WSN settings and to the collected information is also a necessary measure of protection. These techniques in conjunction with the appropriate organization of interaction of sensor nodes in the WSN allow to achieve required level of security and privacy.

3 Fault tolerance

Errors in a WSN can occur for the following reasons: malfunction of one or more of sensor nodes, the change of environmental conditions, the actions of the attacker. According to most common practices, sensor node can be considered as failed if it sends measurements which significantly deviate from the results of the neighbor sensor nodes [51]. A faulty sensor node can be identified by the WSN as workable but provide bad measurement results.

A WSN intended for critical tasks has to operate well even if some nodes fail. In order to ensure a given level of fault tolerance, appropriate error correction mechanism must be provided. Besides, the WSN is

required to ensure reliability and availability of the WSN infrastructure in order to handle a single sensor node failure. In case of such failures, the capabilities of the failed sensor nodes can be dynamically delegated to sensor nodes in order to provide consistent functioning and to prevent failure of the critical task.

Context Awareness

Context involves the information which can be used to describe the state of some physical object. This information has to be considered when making responsible decisions based on WSN measurements. For example, many of the processes are affected by temperature and time of day (especially in e-health applications). Without consideration of such dependencies, the data obtained from the WSN can be interpreted incorrectly. Data processing and decision- making systems of the WSN should also take into account the natural noise in sensor nodes, possible node failures and other sources of context information. For this purpose, context information is required to be collected, stored and used for decision making.

Quality of Service

The strict reliability requirements are often a key challenge for WSN utilization for critical tasks. Some applications require low latency in updating sensor readings, others may require high accuracy of measurements. Time response and accuracy characteristics of a WSN affect the accuracy and timeliness of the decision-making. Critical tasks ordinary need high levels of both of these parameters. Appropriate QoS mechanism must be implemented to make sure that QoS requirements are satisfied [52].

Emergency management

Emergency management is a good example of critical tasks where WSN can find its application [53]. Telecommunications during an emergency play crucial role in rescue coordination. And WSNs, and, in particular, sensor control networks (SCNs) which are considered in Section 6.4, are well applicable in this field because of easy deployment and self organization features. Besides monitoring the state of emergency and providing communication in emergency situations, WSNs have another potentially important application concerning emergency situations and saving people's lives. This application was described in [54].

An indoor emergency management system is based on SCNs. The main goal of the system is to provide everyone in the building with instructions concerning the appropriate way of evacuation. The system uses a personal mobile phones or tablet computers to deliver information to their owners. So every mobile device turns into a terminal of the rescue system in case of emergency. It is very reasonable due to the wide spread of mobile devices and because of the presence of additional communication channels in today's mobile devices.

At the entrance to the building a mobile user terminal automatically connects to the SCN infrastructure and obtains data from the SCN motes. While normal operation, system uses SCN motes to observe the physical conditions inside the building (temperature, smoke, etc.) as shown in Figure 1.1. When an emergency occurs, SCN motes automatically detect it. Then the information about the detection of signs of disaster spreads throughout the SCN and user terminals. Each user terminal automatically launches software for guidance in emergency cases. It gives instructions on the safest way of self-evacuation from the building. For example it can show one of the following: evacuation plans or maps; step-by-step sound commands and visual hints (e. g. interior photos with arrows towards the exit overlaid); videos showing how to use safety equipment. Especially important that the information displayed varies depending on the location of the user.

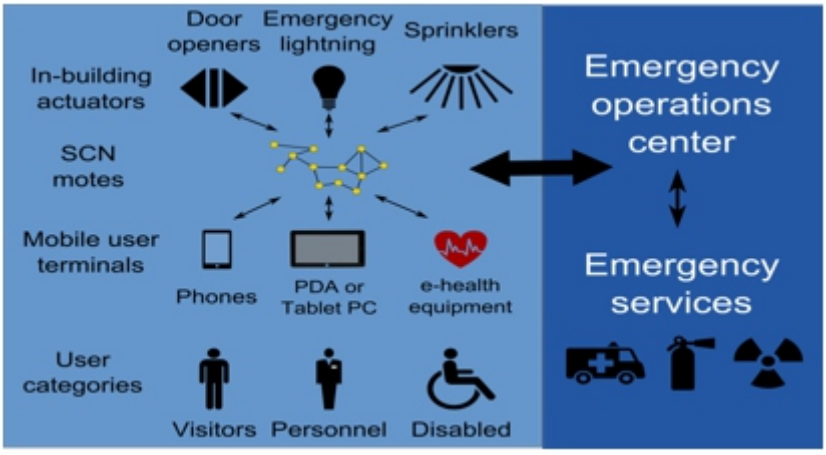

Figure 1.1: Emergency management system

The content of the instructions, which the system gives through the device to the owner, depends on various factors, for example:

- State of the building like accessibility and hazard level of rooms and escape routes. The state is determined by SCN motes;
- Position of the user determined by the nearest network node or using the GPS or GLONASS;
- User's health state determined by the e-health equipment.

User peculiarities awareness is a crucial feature of system. It means that while the personal mobile equipment is used the owner can chose appropriate customization options in software. These options will have impact on the instructions shown by the system. For example, a person with disabilities will receive special self-evacuation route, equipped with necessary facilities. Another example of customization is special instructions for building personnel. The system will remind them if they have specific duty responsibilities in case of emergencies. Also, the system will point to location of people with disabilities who need help.

In-building actuators (e. g. automotive door openers, emergency lightning and sprinklers) should also be equipped with SCN motes. Such actuators will also get commands from the system and start working if necessary.

4. Solution and Verification networks

Verification networks [55] are intended for the systems that operate automatically without human intervention. For a machine actuation unit in such automated system there exists a set of critical operations. Such operations can cause considerable negative consequences when carried out in improper system state. To avoid this for each critical operation a set of verification rules should be defined, which must be checked up before this operation and/or while the operation is in progress. Verification network can be designed to test these conditions. This type of critical task can be solved by using WSNs or SCNs. In this case the WSN should provide some kind of addition context awareness for automated systems.

To check verification rules the values of a number of parameters must be determined. Such parameters can be:

- Aggregate values, reference values, sensor readings presenting in SCN as part of normal flow of decision-making;
- Aggregate values, reference values, sensor readings presenting in SCN which are only intended to support verification;
- Sensor reading obtained from the machine actuation unit's own sensors;
- Values obtained by request from SCN server or other servers in NGN.

Verification network may have much more strict requirements concerning the reliability, security and performance. Data processing and transmission in a SCN for the purpose of verification may have higher priority in QoS in comparison with other activities in the SCN.

In Figure 1.2 a normal SCN decision-making flow is shown (see Section 6.4), but as soon as decision sets a machine actuation unit in motion, the verification process starts up by the verification network. If some of the check-ups of the verification process fail, some safe action (or no action) is performed instead of the action supposed in the decision.

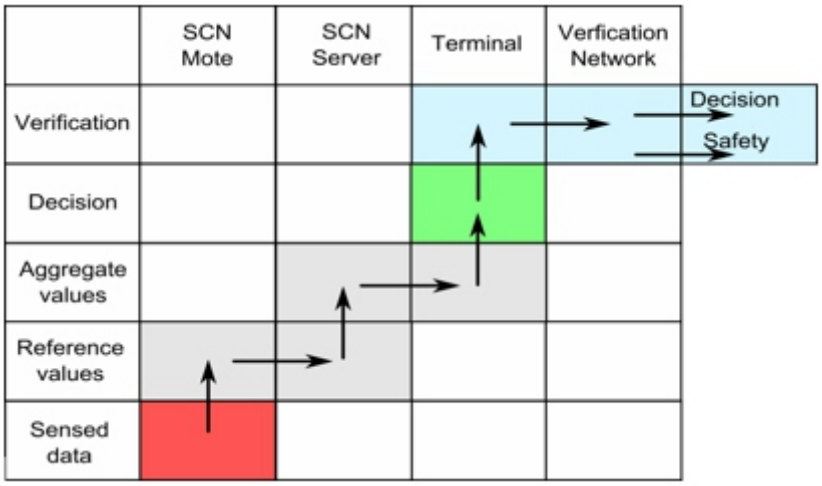

Figure 1.2: Verification network's decision-making flow

5. Conclusion:

A large private company in California implemented a WLAN to support enterprise mobility. The system was seemingly working great and providing significant benefits to its users. Over a year after the system went operational, the IT department noticed, through a routine network security audit, that several of its printers in the financial department had been configured to send all printed data to a file at a suspicious IP address. Unfortunately, the IT department had not locked down the administrative access ports on these printers. Even though all the details of what happened here are not known, it is likely that a hacker gained unauthorized access to the WLAN (which did not implement any form of authentication) and ran a port scan to find the open printer administration port. With the open port's IP address (resulting from the scan), the hacker could easily log in to the administrative port and set the printer to send all print jobs to a file located on the hacker's laptop. The printer would then continue to print on paper and also send the print data to the hacker's laptop. Of course this would send to the hacker everything that the printer would print, such as internal goals and objectives, company sales information, employee salaries, and so on. After discovering this issue, the company promptly implemented an authentication system to disallow all unauthorized people from accessing the WLAN.

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Analytical Study Of The Problem Of Network Routing With Data Communication Speed

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ABSTRACT

Ad-hoc networking is a concept in computer communications, which means that users wanting to communicate with each other form a temporary network, without any form of centralized administration. Each node participating in the network acts both as host and a router and must therefore is willing to forward packets for other nodes. For this purpose, a routing protocol is needed.The Internet Engineering Task Force currently has a working group named Mobile Ad- hoc Networks that is working on routing specifications for ad-hoc networks. This master thesis evaluates some of the protocols put forth by the working group. This evaluation is done by means of simulation using Network simulator 2 from Berkeley.The simulations have shown that there certainly is a need for special ad-hoc routing protocol whenmobility increases. More conventional routing protocols like DSDV have a dramatic decrease in performance when mobility is high. Two of the proposed protocols are DSR and AODV. They perform very well when mobility is high. However, we have found that a routing protocol that entirely depends on messages at the IP-level will not perform well. Some sort of support from the lower layer, for instance link failure detection or neighbor discovery is necessary for high performance. The size of the network and the offered traffic load affects protocols based on source routing, like DSR, to some extent.

1. INTRODUCTION

Wireless correspondence between versatile clients is ending up more prevalent than any time in recent memory. This because of late innovative advances in smart phones wireless information specialized gadgets, for example, wireless modems and wireless LANs. This has prompt lower costs andhigher information rates, which are the two fundamental reasons why versatile registering keeps on getting a charge out of quick development [1].

Impromptu networks don't depend on any pre-built up foundation and can thusly be conveyed in places with no framework. This is helpful in a fiasco recuperation circumstances and spots with non-existing or harmed correspondence framework where fast arrangement of a correspondence network is required. Impromptu networks can likewise be helpful on meetings where individuals taking an interest

in the gathering can shape an impermanent network without drawing in the administrations of any prior network [2].

A wireless specially appointed network is an accumulation of versatile/semi-portable hubs with no pre-built up foundation, shaping a transitory network. Each of the hubs has a wireless interface and communicates with each other over either radio or infrared. Smart phones individual computerized aides that communicate specifically with each other are a few cases of hubs in a specially appointed network. Hubs in the specially appointed network are regularly portable, however can likewise comprise of stationary hubs, for example, get to focuses to the Internet. Semi versatile hubs can be utilized to convey hand-off focuses in zones where hand-off focuses may be required incidentally [3].

Zone Routing Protocol - ZRP

Zone Routing Protocol (ZRP) is a crossover of a responsive and a proactive convenation. It separates the network into a few steering zones and indicates two completely segregated conventions that work inside and between the directing zones.

The Intrazone Routing Protocol (IARP) works inside the steering zone and takes in the base distance and courses to every one of the nodes inside the zone. The convention is not characterized and can incorporate any number of proactive conventions, for example, Distance Vector or connection state directing. Diverse zones may work with various intrazone conventions as long as the conventions are confined to those zones. An adjustment in topology implies that refresh data just engenders inside the influenced directing zones instead of influencing the whole network. The second convention, the Interzone Routing Protocol (IERP) is receptive and is utilized for discovering courses between various directing zones. This is helpful if the goal node does not exist in the directing zone. The convention at that point broadcasts (i.e. bordercasts) a Route REQuest (RREQ) to all fringe nodes inside the directing zone, which thus advances the demand if the goal node is not found inside their steering zone. This technique is rehashed until the point when the asked for node is found and a course answers is sent back to the source showing the course.

Properties

ZRP is an exceptionally fascinating convention and can be balanced of its operation to the present network operational conditions (e.g. change the steering zone distance across). However this is not done dynamically, but rather it is proposed that this zone sweep ought to be set by the organization of the network or with a default an incentive by the producer. The execution of this convention depends a considerable amount on this choice.

ZRP likewise restricts spread of data about topological changes to the area of the change just (instead of a completely proactive plan, which would essentially surge the whole network when an adjustment in topology happened). Nonetheless, an adjustment in topology can influence a few steering zones [4].

Transiently Ordered Routing Algorithm - TORA

Transiently Ordered Routing Algorithm (TORA) is a circulated directing convention. The fundamental hidden algorithm is one of every a family alluded to as connection inversion algorithms. TORA is intended to limit response to topological changes. A key idea in its plan is that control messages are regularly limited to a little arrangement of nodes. It ensures that all courses are without circle (brief circles may shape), and regularly gives various courses to any source/goal combine. It gives just the directing instrument and relies upon Internet MANET Encapsulation Protocol (IMEP [5]) for other fundamental capacities.

Properties

The conventions basic connection inversion algorithm will respond to interface changes through a basic confined single go of the disseminated algorithm. This counteracts CLR parcels to engender too far in the network. A correlation made by the CMU Monarch extend has however demonstrated that the overhead in TORA is very vast on account of the utilization of IMEP.

2. PROBLEMS WITH PROTOCOLS

Applications like natural surroundings observing [6], intermittent accumulation of ecological parameters like temperature, dampness and so forth can endure a misfortune in data bundles yet in occasion identification sensor networks the basic data relating to the occasion must be dependably transported to the focal station or sink. Cases of occasion location applications incorporate target recognition and following and stock administration utilizing sensors with RFID perusers mounted on them [7].

Comparisons with TCP for Internet

The transmission control protocol (TCP) is a vehicle layer protocol that gives end-to-end dependability to the web. A TCP like transport layer protocol is not appropriate for sensor network because of the accompanying reasons

1. Address centric routing - TCP utilizes one of a kind IP address for the end frameworks while certain uses of sensor networks utilize data-driven routing. For these applications a TCP protocol won't be reasonable.

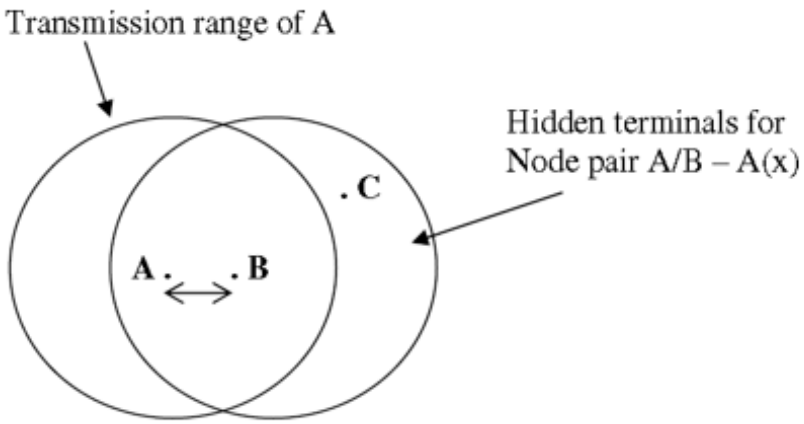
2. Header overhead – TCP utilizes a vast header to incorporate data with respect to grouping number, rendition, choices and so on which is an overhead for an asset obliged sensor network.

3. Energy inefficiency – TCP utilizes end-to-end affirmation and retransmission plot for ensuring dependable data exchange. Such mechanisms for ensuring end-to-end dependability are vitality wasteful for sensor networks.

4. Response to packet losses - TCP translates the reason for parcel misfortunes to be network clog where as in wireless networks the bundle blunders are frequently because of bit-mistakes. So a TCP for wireless sensor network will misjudge the parcel misfortune as clog and lower the sending rate despite the fact that the network is not congested.

The Hidden Node problem

Assume that node A needs to transmit to node B situated at a separation x from A. By just detecting the medium, node A won't have the capacity to hear the transmissions by any node (C) in the dashed range meant by A(x), and will begin transmitting, prompting collisions at node B.



AC Protocol : W.Yeet. al in propose S-MAC a medium get to control protocol for wireless sensor networks which has the accompanying elements –

- The creators propose a low-obligation cycle plot for multi-bounce networks that lessens vitality utilization because of sit out of gear tuning in. Sit still listening alludes to the nodes tuning in to the wireless channel notwithstanding when it is not expecting any messages. Each node keeps up a timetable for rest and listen cycles.

- They propose a RTS/CTS (Request to send, Clear to send) mechanism for collision evasion. This mechanism takes care of the shrouded node issue by trading the control data bundles – RTS and CTS before really sending the data parcel. This builds the dependability of bundle conveyance for substantial data message sizes (100 bytes – 200 bytes) when contrasted with the CSMA protocol [8]. However for littler data sizes the trade of control bundles – RTS and CTS – is an overhead as far as vitality utilization and inertness.

Packet Block Delivery

Block exchanges are required when a lot of data (e.g., code refreshes) must be transported. One vital component of such block exchanges is that NACKs (Negative affirmations) can be utilized. This possibly lessens the quantity of affirmation bundles [9].

A NACK is viewed as a retransmission asks for issued by the recipient. At the point when a middle node reserves the portions, it can serve such a demand and also the first source node could however with the advantage that the NACK and the accompanying retransmitted section don't have to venture to every part of the whole separation amongst source and sink node. Such a node is likewise called a recuperation server. In an outrageous case, all nodes in the network could spend cradle for storing [10].

Reliable Multi-hop Routing

The mechanisms considered in the past areas are at a larger amount and makes a few presumptions about the routing layer. A. Charm et.al. in ponder the issues and answers for solid multi-jump routing issue in sensor networks with low-control radio handsets. They demonstrate that the connection network measurements must be caught progressively through a productive yet versatile connection estimator and routing choices should endeavor such availability insights to accomplish dependability. Likewise they think about and assess connect estimator, neighborhood table administration, and solid routing protocol systems [11].

Connection Estimation: The goal is to discover an estimator that responds rapidly to possibly vast changes in interface quality, yet is steady, has a little memory impression, and is easy to figure. Responding to changes rapidly enables larger amount protocols to adjust to ecological changes and portability. In any case, estimations should likewise be genuinely steady; on the off chance that they change uncontrollably, the routing topology is probably not going to balance out and routing issues, for example, cycles and stranded nodes, will be normal. Likewise, the memory impression of the estimator must be little, as we have constrained capacity in which to speak to the area, and its computational load ought to be little, since just restricted preparing is accessible and it costs energy [12].

3. EXPERIMENTAL TEST BED

The test bed comprises of 5 – 8 Mica2 bits running TinyOS working framework.

Mica2 bits : Mica2 bits are the third generation wireless sensor network gadgets offered by Crossbow Inc. They have the accompanying qualities:

- **Program Flash Memory :** 1 28k byte
- **Battery :** 2x AA batteries
- **User Interface :** 3 LEDs
- **Size(in) :** 2.25 x 1.25 x 0.25
- **Weight(oz) :** 0.7
- **Multi-Channel Tranceiver :** 315, 433, or 868/916 MHZ

nesC : Network installed framework C (nesC) is an open source programming dialect that is particular for sensor networks. It is an expansion of C, which is a dialect that is upheld by numerous microcontrollers and incorporates the important elements to interface with equipment. nesC characterizes a segment based model so as to make it conceivable to part applications into discrete parts which speaks with each other utilizing bidirectional interfaces.

nesC does not allow isolate arrangement as C does. This is on the grounds that nesC utilizes whole program investigation to enhance the execution and make the source code more protected. Since the measure of the application regularly is moderately little the requirement for independent assemblage is not exceptionally basic. nesC is a static dialect implying that the memory allotment for the application is settled after the gathering. This has the impediment that it's unrealistic to utilize dynamic memory distribution and capacity pointers. The points of interest are that it is conceivable to additionally enhance the source code wellbeing at gather time to identify conceivable data races and to make it less demanding to enhance the source code for better execution. nesC likewise has a straightforward simultaneousness show and with the order time investigation most data races coming about because of simultaneousness can be distinguished [13].

TinyOS : TinyOS is an occasion driven working framework intended for sensor networks, where requests on simultaneousness and low power utilization are high however the equipment assets are constrained. TinyOS is composed in nesC and a great part of the outline of nesC was really done in an approach to expand the execution and use of TinyOS. TinyOS gives various framework segments that can be reused in numerous applications. The segments are wired together to the last application by utilizing execution autonomous wiring particular. The occasion based simultaneousness demonstrate TinyOS utilizes has a nearby connection to the simultaneousness show that nesC employments. TinyOS utilizes two sorts of simultaneousness, errands and occasions. Errands are rush to finish and can't seize each other. They are to be utilized for calculation forms where timing prerequisites are not strict. The undertakings can be posted by the segments and are run when the scheduler says [14].

Occasions likewise rushed to fruition yet can appropriate different occasions and errands. They can be utilized to deal with time basic operations and equipment interferes. The basic simultaneousness demonstrate that TinyOS utilizes offers generally high simultaneousness yet with low overhead as opposed to strung simultaneousness which requires a ton of overhead. The data races that can happen when utilizing simultaneousness are distinguished by the order time investigation that nesC compiler offers.

TOSSIM : TOSSIM is somewhat level simulator for TinyOS wireless sensor networks [15]. It has the accompanying remarkable components:

- Completeness. The recreation covers however many framework practices as would be prudent.
- Fidelity. The simulator can catch the conduct of the nodes in detail
- Scalability. It has the ability to mimic an extensive number of nodes all the while; else it is difficult to recreate a whole network.
- Bridging. Blunders frequently happen because of an off base execution of an appropriate calculation. The simulator utilizes a similar code that is utilized to program the equipment, which implies that the mistakes in the usage will be identified.

4. LIMIT OF MULTICHANNEL NETWORK

The limit of multichannel self-assertive networks is restricted by two requirements (depicted underneath), and each of them is utilized to get a bound on the network limit. The base of the two limits

(the limits rely upon proportion between the quantity of channels c and the quantity of interfaces m) is an upper bound on the network limit. While there might be different imperatives on limit too, the requirements we consider are adequate to give a tight bound. Later in this area, we will show a lower bound that matches the upper bound set up by the two imperatives, which approves our claim that the limitations are tight. We determine the limits under channel display 1, in spite of the fact that the induction can be connected to channel show 2 too.

5. CONCLUSION

The capacity analysis has shown that a single interface may suffice for random networks with up to O(log n) channels. The capacity-ideal lower bound construction used to help the above claim depends on certain assumptions, all of which may not be fulfilled by and by. For instance, we accept that interface switching delay is zero, transmission range of interfaces can be deliberately controlled, and there is a centralized mechanism for coordinating course assignment and scheduling. In addition, the hypothetical analysis infers asymptotic outcomes, and capacity can be enhanced by constant factors in the lower bound constructions by using various interfaces. From Section 3.5, we note that when interface switching delay is not zero, having more than one interface might be beneficial. Moreover, convention design has identified many benefits of using no less than two interfaces at every node, for example, allowing full-duplex transfer, and simplifying the development of conveyed

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Effective Analysis Of Power Techniques For Embedded Systems And Its Applications

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A B S T R A C T

The principle goal of this research is to examine the different effective optimization techniques for reducing power consumption in embedded systems with no tradeoff with the coveted and important tasks it needs to perform. As embedded systems are utilized as a part of an extensive variety of applications, there is a need to meet the design measurements of embedded systems like memory, power, time to advertise, flexibility, robustness, cost, performance and some more. Power consumption is especially a vital design metric for battery powered embedded systems (little estimated batteries can have extremely restricted lifetime). Power optimization can be executed utilizing different techniques like Dynamic Voltage scaling, Dynamic Frequency Scaling, Software Optimization, Power down mode and Sleep mode. Notwithstanding, power consumption is likewise imperative in systems running from power supplies, since the IC chips can wind up hot immediately when their clock speeds are expanded. This paper concluded that the minimizing power consumption in such conditions is particularly alluring to enhance unwavering quality and system cost. Smaller batteries can be used, additionally reducing the span of the system. Lower power likewise helps shield portable systems from becoming hot amid drawn out use. Mobile phones, PDAs, MP3 players, digital still and video cameras, electronic instruments and other handheld devices would all be able to end up smaller, run cooler and work longer between accuses of lower power consumption. It likewise prompts higher circuit dependability.

1. Research Background

Embedded systems speak of a critical fragment of the current electronic industry. Applications that use embedded systems change from vehicle control circuits, buyer hardware and matching systems, from remote sensing to basic units of the family unit. All systems that are part of electronically programmable components designed to develop particular capabilities, however, are not seen or used as computers, they are not known exclusively as embedded systems. A substantial level of the global microprocessor market is full of miniaturized scale controllers that shape the programmable center of embedded systems. Despite small-scale controllers, embedded systems can include potentially field-programmable ASICs or groups of portsand, in addition, other programmable register units, for example, digital signal processors (DSPs).

Today, embedded systems are designed utilizing for the most part a specially appointed approach that is intensely in light of prior involvement with comparable items or manual design. Utilization of more elevated amount dialects, for example, C helps to some degree, however with expanding many-sided quality the present approach isn't adequate. Formal check and programmed synthesis of implementations are the surest approaches to ensure security. Be that as it may, both formal check and synthesis from large amounts of deliberation neglect to rival the quickly expanding many- sided quality and heterogeneity found in normal embedded systems. This persuades this design approach ought to be founded on the utilization of at least one formal models to portray the conduct of the system at an abnormal state of reflection.

One of the first embedded systems was the Apollo Orientation Computer, created ca. 1965 by Charles Stark Draper at the MIT Instrumentation Laboratory. At the beginning of the business, the Apollo PC address was considered less secure in the Apollo business, because it used the newly created solid circuits incorporated to reduce size and weight. A mass embedded system created was in charge early PC Autonetics D-17 Minuteman rocket, discharged in 1961. At that time the Minuteman II went into the creation in 1966, the D-17 was supplanted with another PC was the main large volume of use of embedded circuits. Since these early applications in the 1960s, embedded systems have declined in costs and there has been emotional growth in the preparation of power and utility. One of the first microchips, for example, the Intel 4004, was designed to add machines and other small systems, but at the same time it needed external memory and support chips. In 1978, the National Engineering Manufacturers Association issued a "standard" for programmable microcontrollers, including PC-based controllers, for example, single-board computers, numerical controls and event- based controls.

2. POWER OPTIMIZATION TECHNIQUES FOR EMBEDDED SYSTEMS

The power reduction problem can be studied by identifying and optimizing the important factors affecting the power dissipation. The factors such as technology, circuit approaches, architectures, and algorithms greatly influence the total power dissipated in the system. Optimizing technology will involve choosing suitable hardware components such as processors, memory, peripheral devices; power sources. The power optimization techniques are related to hardware as well as software implementation [1].

Static Power/Leakage Power Reduction Techniques

Static power dissipation in submicronic technologies is caused by leakage and sub threshold currents

that contribute to a small percentage of total power consumption. As the technologies are reduced to ultra-deep submicronic technologies, static power dissipation increases predominantly and therefore the reduction of static power has also become a major concern. There are some approaches to minimize static electricity and spillage. One of these techniques is known as Multi-VT: high VT cells are used as long as performance targets allow it and low VT cells when they are important to meet planning requirements. A second technique consists in closing the power supply to a square of logic circuits when it is not dynamic. This approach is known as turning on the door. The use of the complementary step logic (CPL) can be careful with the dissipation of static power. To counteract the misfortune of performance and improve power efficiency, several Vdd and multiple Vth techniques have been proposed. Ports in basic shapes work in the higher Vdd or in the lower V, while those in a non-base mode work in the lower or higher Vdd, along these lines, which reduces the overall power consumption without degrading performance.

- **Gate Sizing :** is another powerful way to optimize power. It is possible to examine the logical gates in the basic ways, to meet the planning prerequisites at the expense of greater power consumption; while those in non-basic ways can be estimated to reduce power consumption. To manage the power of spill that expands regularly, apart from the multiple Vth technique, another arrangement is:

- **Forced stacking :** The stacking effect or automatic reversal of the inversion can reduce the escape of the lower limit when killing more than one transistor in the stack. The long channel gadget is a technique to reduce the spill of the gate that occurs due to the excavation current through the gate oxide and using channels of no less length.

The CMOS variable threshold (VTCMOS) is another exceptionally effective method for mitigating standby spreading power [2]. By applying an inverse bias voltage to the substrate, it is possible to decrease the estimate of the term (VGS-VT), effectively expanding the VT. This approach can reduce spill pending a maximum of three extension requests. In addition to the Multi Edge logic, the techniques for optimizing memory and clock synchronization will also reduce static electricity and misses.

Dynamic Power Reduction Techniques

Dynamic power consumption is the major supporter for add up to power consumption and it comes about because of charging and releasing of parasitic capacitive heaps of interconnects and devices.

There are a few optimization techniques in equipment likeGate level power optimization, Multi VDD, clock gating Dynamic recurrence scaling (DFS), Dynamic voltage scaling, (DVS), Dynamic power management, Power gating, memory optimization techniques. Programming optimization techniques, for example, Low power transport encoding, Reconfigurable direction encoding, and Instruction pressure, Object code consolidating and decompression, Hardware programming dividing, Instruction level power optimization, Control information stream changes, are executed on processors, Memory, SoC, IPCORE, Interfaces. These techniques with applicable papers are talked about in this area.

Gate Level Power Optimization

Gate level power optimization incorporate cell sizing and support addition. In cell sizing, the apparatus can specifically increment and lessening cell drive quality all through the basic way to accomplish timing and after that decrease dynamic power to a base. In support addition, the apparatus can embed buffers as opposed to expanding the drive quality of the gate itself. In the event that done in the correct circumstances, this can bring about lower power. Like clock gating, gate level power optimization is performed by the implementation devices, and is straightforward to the RTL designer.

Voltage Scaling Approaches

The approaches to voltage scaling are :

- **Static Voltage Scaling (SVS) :** distinctive squares or subsystems are given diverse settled supply voltages.

- **Multi-level Voltage Scaling (MVS) :** an augmentation of the static voltage scaling situation where a square or subsystem is swap between at least two voltage levels. Just couple, settled, discrete levels are upheld for various operating modes.

- **Dynamic Voltage and Frequency Scaling (DVFS) :** an augmentation of MVS where a larger number of voltage levels are dynamically changed between to take after evolving workloads.

- **Adaptive Voltage Scaling (AVS) :** an augmentation of DVFS where a control circle is used to change the voltage.

The factors voltage and recurrence have a swap off amongst deferral and power consumption. Reducing clock recurrence f alone does not lessen power, since to do a similar work the system must run longer. As the voltage is diminished, the postponement increases [2]. A typical way to deal with power lessening is to first expand the performance of the module - for instance by including parallel equipment, and afterward diminish the voltage however much as could reasonably be expected till the required performance is achieved (Figure 1).

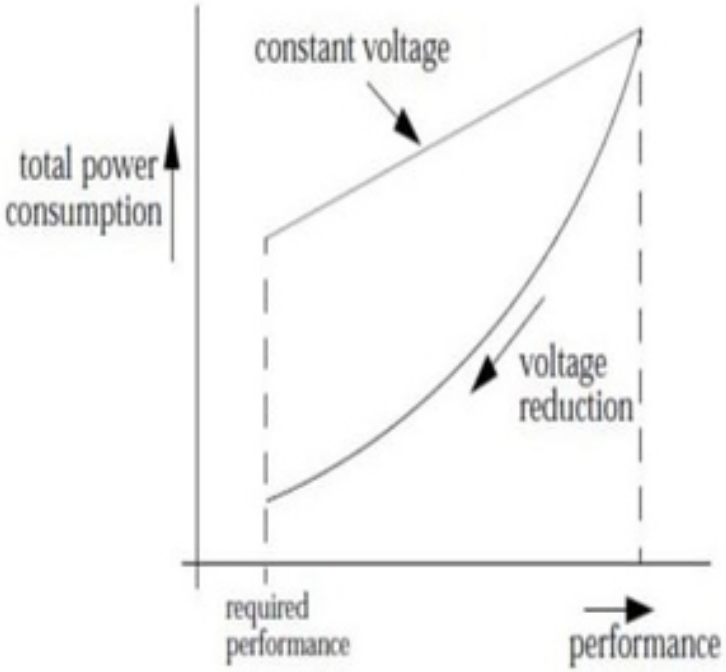

Figure 1 Impact of Voltage Scaling and Performance to Total Power Consumption

Power Saving Modes

SoCs offer a wide range of power sparing modes giving the cell phone designer the capacity to swap off between power consumption in standby and recuperation times as appeared in Figure 2

Run : this is the ordinary and utilitarian operating mode of the SoC. The recurrence of the centre and the operating voltage can be dynamically changed in a range. Wait: in this mode, the clock in the middle of the processor is closed. The operation continues in the interruption. This mode is useful for running low MIPS applications that primarily include peripheral activities, such as a viewer.

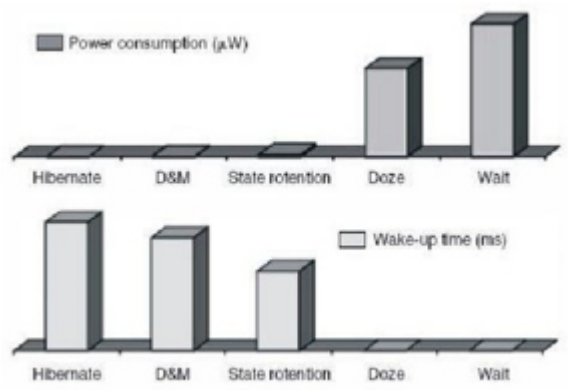

Figure 2 Power Saving Modes Vs Wake Up Time

Doze : clocks for particular peripherals can be deactivated accordingly in Doze mode by pre-ordering the clock controller module. This mode is useful for processes that require rapid reactivation. The ordinary operation continues in the interruption.

Preservation of the state : in this mode, all the tickers are deactivated and the PLL is disabled. The external memory is positioned in low consumption mode (self- regeneration). The MCU and peripheral stopwatches are closed. The supply voltage can go down to a base. State maintenance uses less power and has a longer activation time than Doze mode, although there are no compelling reasons to recover information after waking up.

Deep sleep : in this mode, the timekeepers are checked. The power supply to the central MCU platform is eliminated. Any relevant registration information must be retained before entering Deep Sleep mode. The typical operation continues in the interruption.

Hibernation : the power of the entire SoC is deactivated. The system is completely dead. The continuous operation is proportional to the cold start. Each internal data must be stored in the external memory before being hibernated.

Low Power Design

Power is an important design metric to be considered in embedded system design since the requirements for portable devices with advanced features are becoming popular. As the size of these devices is becoming smaller, the power dissipation in these devices and also in non-portable devices has to be reduced. More complex processors are being used in these systems which have increased the power dissipation level to a greater extent and hence suitable measures to be taken at the designing stage itself to reduce power.

MULTI VDD

Since dynamic power is relative to VDD2, lowering VDD on chose blocks diminishes power fundamentally. Tragically, lowering the voltage additionally expands the postponement of the gates in the design. [3] Describes the DVS technique for minimizing power in embedded processor keeping up constant deadlines. It makes a pseudo operating recurrence levels for minimization of power.

3. DESIGN TECHNIQUES FOR POWER REDUCTION

There are various techniques described in the literature such as

- Using the devices operating at different voltages
- Using devices operating at different frequencies
- Using devices having different modes of operation (i) Running (ii) waiting and (iii) idle
- Using devices capable of operating at different clock speeds
- Using scheduling techniques in the software program for reducing power consumption in embedded systems.

It is clear from the above discussions that the choice of suitable processors for embedded applications is important. Most of the available processors have implemented one or more power optimization techniques. However there exists a major requirement for the design of suitable architecture with external and internal power optimization. This work focuses on the study of various power optimization techniques for embedded system followed by the design of an embedded system and implementation of power optimization techniques.

Power Optimization Using Software Techniques

This segment solely manages the different software optimization techniques like Bus Encoding, Instruction Coding andCompression, Object Coding and Merging, Memory Optimization, Hardware-Software Partitioning, Compiler optimization, Data Flow Transformation with pertinent papers.

Variable Voltage Techniques

Probably the most effective approach to decrease power consumption is to lower supply voltage. Traditionally, systems have been designed to work at settled supply voltages. [4] The algorithms have on the web and offline components. All tasks meet the deadlines with huge power savings. The offline part expect that the tasks run to the most pessimistic scenario execution time and computes the voltage settings to limit power consumption.

4. APPLICATION

Power is an essential design parameter to be considered for optimization. Power dissipation has turned into an essential design thought, because of the multiplication of battery-driven versatile systems, worries about circuit dependability and bundling costs. An embedded system might be required to run constantly and unattended in remote spots where size, unwavering quality and power assume essential parts. There is dependably a swap off existing between design metrics. Eg. Optimization of power ought not to corrupt the performance of the system. It is a test for the designer to execute the most pertinent technique/scheme for optimization amid the design process to adjust these design metrics. Low power consumption is essential for every single embedded system; however the reasons shift fairly for various applications. In matrix powered systems, lowering the power diminishes operating costs, builds dependability and permits minimal design that grants greater usefulness to be stuffed into a similar space, with fewer requirements for fans and other cooling techniques. In basic applications, for example, top quality medical imaging, heat can even cause operating issues, nullifying the point of the gear, so low power dissipation is basic.

5. CONCLUSION

Power is one of the primary design parameters in the design of embedded systems. Embedded processors typically work under tight environmental constraints where they frequently don't approach a consistent wellspring of power. Subsequently, they need to work at a really low power spending to drag out the constrained battery life. A considerable lot of the present age embedded processors perform computationally serious tasks, for example, picture and video processing with ongoing constraints. Hence, it is basic that we focus on power sparing techniques that don't forfeit on performance.

Several optimization techniques to reduce power consumption are contemplated and analyzed as shown in the theory. As part of the test work, an power management controller has been designed that

monitors and controls the power consumption of peripheral devices. DFS, Clock Gating and shutdown modes are represented with occurs. This document represents the test work with system level optimization and power savings of approximately 30-40%. The proposed optimization technique depends on the following observations:

1. The smallest memory size becomes less power will be consumed. Consider that not only the number of words is equal to the width of the memory bit.

2. Access to memory is highly uneven.

3. There are many factors, where many bits are never used in the middle of program executions.

4. Variables with disjoint life-times may share the same memory space.

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An Investigation Of Delay Estimation Model For Effective High Spped VLSI

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A B S T R A C T

In this paper a closed shape matrix rational model for the calculation of step and limited incline reactions of Resistance Inductance Capacitance (RLC) interconnects in VLSI circuits is displayed. This model permits the numerical estimation of deferral and overshoot in loss VLSI interconnects. The proposed technique depends on the U-change, which gives rational capacity approximation to getting inactive interconnect model. With the decreased request loss interconnect exchange capacity, step and limited slope reactions are acquired and line deferral and flag overshoot are assessed. The assessed deferral and overshoot qualities are contrasted and the Euder strategy, Pade technique and HSPICE W-component model. The half postpone results are in good agreement with those of HSPICE inside 0.5% mistake while the overshoot blunder is inside 1% for a 2 mm long interconnect. For global lines of length more than 5 mm in SOC (framework on chip) applications, the proposed technique is observed to be almost four times more exact than existing methods.

Keywords – Delay; matrix rational model; ramp input; RLC interconnects; transient analysis; transfer function; U-approximation

1. INTRODUCTION

As the physical dimensions in VLSI technologies downsize, interconnect delay rules the entryway delay in deciding circuit execution [1]. In profound submicron VLSI circuits it is important to have computationally economical and exact interconnect postpone models. In this way for the plan of complex circuits, more precise explanatory models are expected to foresee the interconnect delay precisely.

Initially VLSI interconnects were modeled as RC lines and single post Elmore-based models [2]–[3] on account of long channel gadget postpone predominance over unimportant interconnect delay. However for rapid interconnects, inductance impacts are ending up plainly dynamically imperative and can never again be disregarded. Under these conditions, the Elmore model comes up short since it doesn't consider the inductance impacts [4]. It is important to utilize a moment arrange model, which incorporates the impact of inductance. Kahng et al. considered proportional Elmore defer model in

view of the Resistance Inductance and Capacitance (RLC) of the interconnects [4] and [5]. Ismail et al. [6] proposed two shaft model to catch far end time domain answer for single line interconnect.

A disentangled voltage exchange work acquired utilizing Taylor arrangement approximation for transient analysis [7]-[8] has less exactness in postpone calculation. Nakhla et al.[9] utilize changed nodal analysis (MNA) for obtaining far end and close end reactions of interconnects. Roy [10] augmented [9] for obtaining more exact far end reactions of coupled RLC interconnects utilizing defer arithmetical equations.

A lattice rational-approximation model for SPICE analysis of fast interconnects is introduced in [11]-[12], be that as it may, the approximations made to determine the models

$$\text{Where}\emptyset = \begin{matrix} 0 & -Z \\ -Y & 0 \end{matrix}$$

added to error. This has been augmented utilizing Pade approximation model [13] to gauge the postponement of interconnects. All the above models still experience the ill effects of different errors and need change for precise defer estimations.

2. ANALYSIS OF RLC INTERCONNECT

The solution of interconnects are described by telegrapher's equations as

$$\frac{\partial}{\partial x} I\ z, s = -sCV\ z, s$$

$$\frac{\partial}{\partial x} V\ z, s = -\ R + sL\ I\ z, s$$

where "s" is the Laplace-change variable, z is a
variable which speaks to position; V(z,s) and I(z,s) remain for the voltage and current vectors of the transmission line, individually, in the frequency domain; and R, L and C are the per unit length (p.u.l.) resistance, inductance, and capacitance matrices, separately.

The solution of (1) can be written as an exponential matrix function as

$$\begin{matrix} V\ d, s & _{-\emptyset d} V\ 0, s \\ -I\ d, s & I\ 0, s \end{matrix}$$

with Z=R+sL and Y=sC. The exponential matrix of (2) can be written in terms of cosh and sinh functions as

$$e^{\emptyset d} = \begin{matrix} \cosh d\sqrt{ZY} & -Y^{-1}\sinh d\sqrt{ZY} \\ -Y_0 \sinh d\sqrt{ZY} & \cosh d\sqrt{YZ} \end{matrix}$$

Where

$$Y_0 = Y\sqrt{YZ}^{-1}$$

3. PROPOSED U MODEL

This model is based on a generalized U- transform [14]. For the power series expansion of a function f(x), where 'x' is a complex variable

$$f(x) = \sum_{n=0}^{\infty} a_n x^n$$

The sequence {sn} is a partial sum of original series

$$S_n = \sum_{k=0}^{n-1} a_k x^k$$

The closed form rational function approximation for an exponential matrix is

$$u_{kn}(S_n) = \frac{\sum_{j=0}^{n+k-1} \gamma^i \sum_{j=0}^{k} w_{knj} s^{j-1}}{\sum_{j=0}^{k} w_{knj} x^i}$$

Where

$$w_{knj} = (-1)^j \frac{k!}{j!(k-j)!} \frac{(n+k-j)!}{a_{n+k-j-1}}$$

Thus uknrepresents a table of rational functions, every component of which is gotten from n + k terms of the first grouping {Sn, n = 1, 2...} and is an approximant of the function f(x) determined previously.

Calculation system for evaluating postponement and overshoot utilizing U- approximants are as per the following.

1. Use the Interconnect line parameters according to Table I.

2. Telegrapher's equations are tackled and the arrangement can be composed as exponential network.

3. This transfer function network parameters can be approximated utilizing the U-model.

4. In the proposed model compute the coefficient of the exponential function i.e., where

$$0 \leq i \leq n$$

5. Calculate wknj from the connection (4)

6. Calculate the internal whole of the Eq(3) numerator.

7. Total of the numerator is gotten

8. Calculate the aggregate total of the denominator of the U-approximants

9. Calculate the U-approximants.

10. Make utilization of the U-approximants to get approximated transfer function

11. Find the time domain response of approximated transfer function utilizing backwards Laplace transform to estimate delay and overshoot of interconnect.

The fundamental thought of the grid rational- approximation model is to utilize foreordained coefficients to analytically get rational functions for (2). To get an inactive model, the exponential function eϕd is approximated utilizing Eq (3) and the resultant model is utilized for obtaining time response.

A solitary RLC line is appeared in Fig. 1.The line is driven by a stage info and 1-V limited ramp with rise time of 0.1 ns. This speaks to an indicate point interconnection driven by a transistor (modeled as a resistance Rs) and connected to the following entryway (modeled as a capacitance Cl).

Fig. 1 Circuit model of the single-line

distributed RLC interconnect

The frequency-domain solution at the far end is expressed as

$$V_f = \frac{V_{in}}{1 + sR_sc_1 \cosh \Gamma d + R_sc_0 + sC_1y^{-1} \sinh \Gamma d}$$

Where

$$\Gamma = \overline{YZ},$$

Rs are the source resistance at the close end, Cl is the heap capacitance at the far end, and Vin is the information voltage. The correct transfer function of dispersed RLC transmission line has cosh and sinh terms, which are increased with Yo and it's inverse. It is to a great degree hard to discover the time domain response of this complex transfer function, so a few approximations are proposed in writing to discover the time domain response. An approximate transfer function has been inferred utilizing U-change. This transfer function is inverse Laplace changed to get time domain response for estimation of postponement and overshoot in single RLC interconnect.

4. SIMULATION RESULTS

The single RLC line is displayed in this area to show the legitimacy and proficiency of the proposed method. The outcomes were acquired utilizing MATLAB R2010a working on HP 64-bit Intel i5 processor with clock speed of 2.53 GHz and are additionally contrasted and HSPICE utilizing the W-element method.

The common interconnect parameters [16] considered for reproduction of single RLC interconnect are given in table-I. The Pade approximation, Eudes model and proposed U- approximation are executed in MATLAB for a similar arrangement of info parameters and different approximation orders.

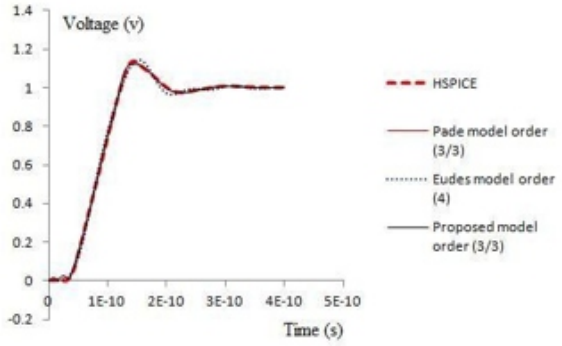
Table I: The values of Interconnects parameters

Vdd	1v
Length	0.2cm
Resistance	88.29Ω/cm
Capacitance	1.8pF/cm
Inductance	15.38nH/cm
Load capacitance	0.05fF to 0.1fF
Source resistance	20Ω to 100Ω
Input ramp rise time	0.1ns

The accuracy of proposed model approved utilizing the frequency response of cosh function as appeared in Fig. 2. The frequency response is gotten utilizing pade (3/3) and proposed U-model (3/3) are contrasted and the correct arrangement of telegrapher's equations. It is observed that, the proposed method is superior to Pade method and well matches with correct cosh function for the order of 3/3 up to the frequency of 25 GHz.

From Fig. 3, it is seen that, the proposed U- approximation and Pade method are close when contrasted with HSPICE. In any case, Eudes model of order 4 has more overshoot when contrasted with different methods.

Fig: 2.Transient analysis of single interconnect line, when length =0.2cm, Rs=50Ω and Cl=50fF.



The MATLAB result of step response and limited ramp response are plotted for the line length of 0.2 cm, source resistance of 100ω and load capacitance of 100fF. Step response in Fig. 4 has less ringing in proposed method when contrasted with Pade method, for a similar approximation order of 3/3, though Fig. 5 gives limited ramp response of single line interconnect utilizing U-model matches extremely well with the HSPICE. Be that as it may, Eudes model needs all the more settling time when compared with the proposed model.

Fig: 3.Step response of single line when length =0.2cm, Rs=100Ω and Cl=100fF.

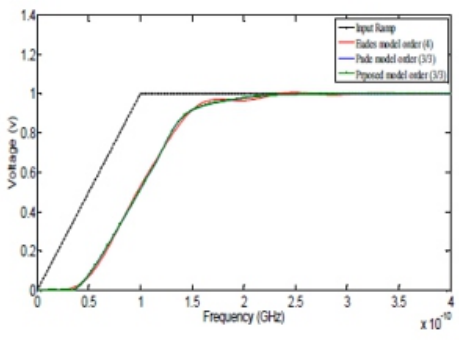


Fig: 4.Ramp response of single line when length =0.2cm, Rs=100Ω, Cl=100fF.

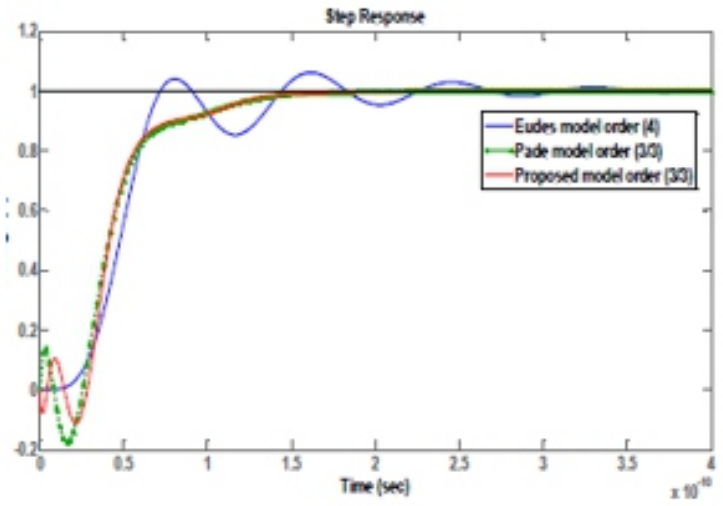


Table II: Comparisons of 50% delay of HSPICE W Element, Eudes model Pade model and proposed model for various lengths source Resistances and load Capacitances.

L (cm)	Rs (Ω)	Cl (fF)	HSPICE	Eudes model order (4)	Pade Order 3/3	Proposed Model order (3/3)
			50% delay (ps)	50% delay (ps) (%Error)	50% delay (ps) (%Error)	50% delay (ps) (%Error)
0.2	50	50	79.8	79.1 (0.8%)	80.2 (0.5%)	80.2 (0.5%))
	100	100	98.7	96.8 (1.92%)	98.6 (.1%)	98.65 (0.05%)
0.5	50	50	135.7	142.8 (5.23%)	137.8 (1.54%)	137.7 (1.4%)
	100	100	156.6	162.6 (3.83%)	151.9 (3%)	155.3 (0.83%)
1.0	50	50	231.2	250.2 (8.21%)	211.1 (8.69%)	224.7 (2.811%)
	100	100	255.6	284.8 (11.42%)	249.7 (2.3%)	252.5 (1.21%)

Table III: Comparisons of overshoot of HSPICE W Element, Eudes model, Pade model and proposed model for various lengths, source Resistances and load Capacitances.

L (cm)	Rs (Ω)	Cl (fF)	HSPICE	Eudes model order (4)	Pade Order 3/3	Proposed Model order (3/3)
			Overshoot (V)	Overshoot (V) (%Error)	Overshoot (V) (%Error)	Overshoot (V) (%Error)
0.2	50	50	1.14	1.14 (0%)	1.12 (1.7%)	1.13 (0.87%)
	100	100	1.00	1.00 (0%)	1.00 (0%)	1.00 (0%)
0.5	50	50	1.15	1.24 (7.8%)	1.15 (0%)	1.14 (0.87%)
	100	100	1.00	1.03 (3%)	1.00 (0%)	1.00 (0%)
1.0	50	50	1.00	1.09 (9%)	1.02 (2%)	1.01 (1%)
	100	100	1.00	1.00 (0%)	1.00 (0%)	1.00 (0%)

The Tables II and III give the comparisons of 50% delay and overshoot values acquired utilizing HSPICE for different lengths, source Resistances and load Capacitances. These tables incorporate the percentage error values as for HSPICE. From Table II the Eudes model of order 4 has most pessimistic scenario error of 11.42%, while Pade and proposed models have 8.69% and 2.811%.

It can be observed that the methods executed for global lines have more error percentage than our proposed method. Both Pade and proposed methods perform correspondingly for littler length interconnects while Eudes method has more error percentage.

As saw in Table III, the Eudes model has most pessimistic scenario overshoot error percentage of 9%, however Pade model has an error percentage up to 2% while the proposed model has error inside 1%. On account of overshoot estimation our model is best for all cases. For 2 mm run lines theproposed method has delay and overshoots errors inside 1%.

5. CONCLUSION

This paper exhibits a U-transform based shut frame model for delay and overshoot estimation of fast VLSI interconnects in DSM administration. A solitary line interconnect has been utilized for approving the proposed model by contrasting and the Eudes model, Pade method and HSPICE. In SOC (framework on chip) applications, for global lines of lengths 2 mm or more the proposed method is observed to be more accurate than existing methods. This method can be utilized to gauge the flag trustworthiness qualities of Carbon nano tubes.

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Impact Of Anthropogenic Activities On Haigam Wetland Using Remote Sensing And GIS

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A B S T R A C T

Wetlands play a vital role in maintaining the overall cultural, economic and ecological health of the ecosystem; their fast pace of disappearance from the landscape is of great concern. Haigam wetland of Sopore Baramulla J&K —one of the beautiful wetland in Jammu and Kashmir is continuously changing due to un-planned anthropogenic activities like Human settlements, expansion of the agricultural fields and the siltation and the wetland of the village has been shrinking. This study evaluates wetland changes in Haigam Sopore Baramulla J&K, between 1969 and 20013. Spatial and temporal dynamics of wetland changes were quantified using one top sheet and two Liss-3 images and the post-classification change detection technique in remote sensing and GIS environment. The analysis revealed that area of wetland decreased significantly over the last 35 years by the conversation of the wetland into human non wetland use like Agricultural, human settlement, pasture land, orchids and vegetable gardens. The total area of the Haigam Lake was 754.32 ha in 1969 and after conversion of this wetland by humans into non wetland use like Agricultural, Human Settlement, orchids, and vegetables gardens it remains only 533.60 ha respectively in 2013. This changing trend of Haigam wetland makes the migratory birds population vulnerable, creating water logging problems and their consequences. Land filling and encroachment were recognized to be the main reasons for shrinking of the Haigam wetland. If the same pace continues then in the near future the Haigam wetland remains no more. If conservation measures are not taken then the consequences are severe and the effects are seen by everywhere especially on the local population.

KEY WORDS: Anthropogenic activities Haigam Wetland, GIS, Remote sensing.

1. INTRODUCTION

The definition of wetlands used for this project was adapted from the U.S. Environmental Protection Agency (EPA) definition that describes wetland as “[areas] that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions” (U.S. EPA, 2003. p.1). Wetlands are often described as "kidneys of the landscape" (Mitch and Gosselink, 1986).

Wetlands are defined as lands transitional between terrestrial and aquatic eco-systems where the water table is usually at or near the surface or the land is covered by shallow water (Mitch and Gosselink, 1986).

The Kashmir valley in Jammu and Kashmir has a large number of wetlands. However, their ecological and socio-economic values were rarely explored. The famous wetlands of Kashmir are Dal Lake, Anchar, Wular, Haigam, Malgam, Haukersar and Kranchu lakes. These wetlands face serious threat from anthropogenic activities like increasing human settlements, urbanization, siltation, expansion of agricultural fields and the expansion of roads.

The present study was carried out in Haigam wetland (Sopore) Reserves. The wetland contributes significantly to the livelihoods of local communities.

Haigam wetland reserve faces severe threat of siltation and agricultural fields by the local community. A great influx of heavy silt load into Haigam from Bakhul and Ningli perennial streams drain directly into this wetland which has resulted in deterioration of wetland quality and has reduced extent of the wetland area in the landscape. The willow plantation was destructed by cutting down the willow trees by the peoples for fuel wood was also observer. The willows were the habitat of many species of birds.

The primary focus of this study was to evaluate the impact of anthropogenic activities on Haigam wetland using remote sensing and GIS, the value of wetlands, the causes and consequences of the loss of wetlands. The encroachments and various developmental activities are the major constraints affecting wetland area changes and its environs.

AIMS AND OBJECTIVES:

AIM:

The aim of this study is to produce a land use land cover map of Haigam wetland at different epochs in order to detect the changes that have taken place particularly in the built-up and Agricultural land and subsequently predict likely changes that might take place in the same over a given period.

OBJECTIVES:

1. To see the anthropogenic activities on Haigam wetland.

2. Examine the extent of use of these wetlands by the local people and their perception and attitude towards this wetland.

3. To make people aware of the importance of wetlands.

4. To make a conservation plan for the Haigam Wetland

STUDY AREA:

Rakh Haigam is a Village in Sopore Tehsil in Baramulla District of Jammu & Kashmir State, India. It is located 22 KM towards North from District headquarters Baramulla, 63 KM from State capital Srinagar with coordinates 34°15'6"N 74°32'3"E.

The Haigam Wetland Conservation Reserve or Haigam Rakh as it is locally called is the largest remaining reed bed in the Kashmir valley, being of major ornithological importance. Haigam is named after a village of the similar name.

The wetland is 40 km from Srinagar, the state capital and located in district Baramulla (34015'N, 74031' E) of Jammu & Kashmir state on the flood plains of river Jhelum at an altitudinal height of 1580 m. It was notified as a game reserve for duck shooting as far back as 1945. Earlier the area was about 14 km with reed beds of about 4 kms (Holmes & Parr, 1988) but now the total reserve has shrunk to 7.25 kms. The wetland is maintained by the Department of Wildlife Protection, Jammu & Kashmir. The wetland is approachable by a motorable road of 5 km from the nearest main town Sopore. The wetland is surrounded all around by villages. Haigam village itself does not border the reserve. An offshoot village, Hanjypora, which is near the edge of the reserve, has the reserve office. The wetland is bounded in the north by Sopore- Sonawari general road. To its south, it is surrounded by villages of Goshbugh and Sukhul. To the east of the wetland is the human habitation of Aakhanpora and to the west it is bounded by village Hanjypora.

The wetland has been classified as wetland type 14, 15 & 19 because of the type of wetland habitat present i.e. freshwater marshes, swamps and rice paddies (Scott, 1989).The wetland is a shallow, permanent, freshwater lake with a maximum water depth 1.25 m. The greater part of lake is dominated by extensive reed-beds. The reed bed is partitioned by a number of boat channels varying in width from 1m to 4m.The wetland is fed by perennial streams of the Bakhul and Ningli flood channels and numerous smaller streams. The water table fluctuates seasonally and falls in late summer and reaches it is lowest in autumn, and then begins to rise again in early winter. Dissolved oxygen reaches very low

levels in summer. The underlying soils are silty-clayey –loam type. The surrounding land is predominantly rice paddy and natural marsh, with some pastures which flood after heavy rains. The reserve is largely surrounded by a protective bank.

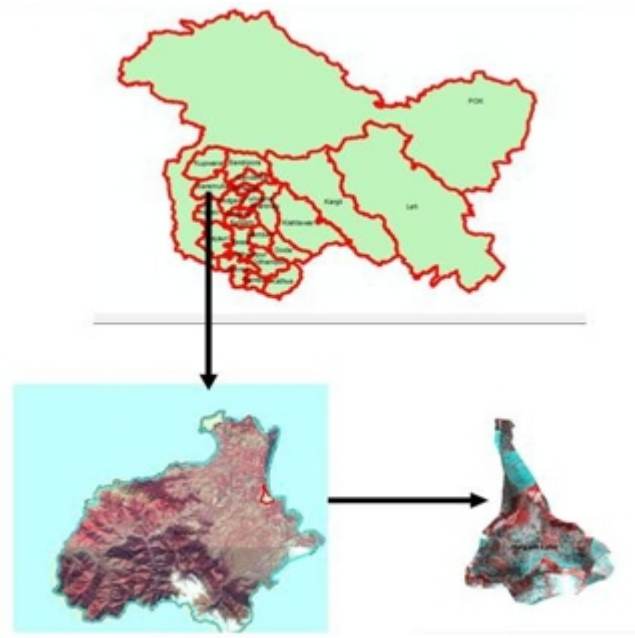

Fig. study Area Haigam Wetland

Inside this bank, strips of willows have been planted. These act as a silt trap. Outside the bank, and in some places inside, the land is mostly devoted to rice paddy. Slightly further from the bank, at least around Haigam, there are extensive orchards.

RESEARCH METHODOLOGY:

DATA COLLECTION:

Methods employed in this study involved a number of activities, both field and laboratory based, were undertaken in order to generate the necessary data. Initial desk study involved a GIS-based assessment of the spatial and temporal changes in the areal extent of the different land-use in order to assess land use changes and possible attendant impacts of human activities on the Haigam Wetland ecosystem.

Top sheet of 1969, Liss III and LISS IV images of 2011 and 2013 were used in the classification procedure. The images have 23 m spatial resolution. Topo sheet, Satellite images of 1969, 2011 and 2013 are taken, with the help of Arc map 9.1 and Edidas software' s. These satellite images were digitized at 5000-10,000 – 50,000 scales. At the end of digitization three maps are drawn i.e. 1969, 2010 and 2013 which shows the results in the form of change detection.

The 1969 top sheet shows the area of the wetland, where most of the portion is dominated by the water, then marshy area. With the passage of time the Haigam wetland is covered by the human settlement, agricultural lands and the siltation.

1n 2011 major portion of the wetland is covered by the siltation, the second is the agricultural lands and the third portion covered with the buildup areas.

In 2013, area of the Haigam wetland is further reduced and the impact of human activities increases where siltation, agricultural and the habitation are dominated.

DATA PROCESSING:

Data were processed using ArcGIS 9.2, Erdas Imagine 8.9, Microsoft Office Excel, and Adobe reader. With the help of ArcGIS 9.2 Topo sheet of 1969 were digitized 5000 – 10000 scale, and after digitization different classes and their total area were obtained i.e. open water, open land, Agricultural fields, slit and habitation. These classes are shown in the table no 1.

Same technique were used with the Liss III images of 2011 and 2013, and after digitization of these satellites images slit load, habitation and agricultural land were increased and the open water and the area of Haigam lake were reduced. These classes were shown in table 2 and table 3.

The land use and land cover areas by pixels were then transferred from the attribute table in ArcGIS to Microsoft Office Excel 2007 to calculate the area covered by each class. And then the total area are then converted into different graphs, which shows that how much area of Haigam lake is covered by each class and these graphs are shown in the graph no 1,2 and 3.

ORGANIZATION OF FIELD WORK:

Field work for the whole study was operated from one location (located at village Gohal, of Haigam wetland, and from one field station (located at village Hanjipora, near Haigam wetland. Field sampling in peripheral villages to collect information on wetland resource dependency of the user communities in addition to a perception and attitude survey. A rapid survey for collection of secondary data from concerned government agencies the fieldwork for this study commenced from August 2014 to November 2015. In this duration, field data collection relevant to different objectives of the study was undertaken.

The data collected from the government agencies related for the conservation of Haigam wetland and interviews are also conducted from the local people about the wetland. After collecting both primary and secondary data, Results were drawn which shows that that the Haigam wetland is reduced in area by the anthropogenic activities like agricultural and human settlements.

RESULT AND DISCUSSION:

GIS-BASED MAPPING OF LAND USE CHANGES:

The research developed and used an integrated methodology of remote sensing data on a GIS platform to analyze and present data as a basis for monitoring land cover change. The GIS-based assessment of the temporal changes in the areal extent of the different land-use type involved evaluation of remotely sensed satellite imagery for the period of 1969, 2011 and 2013, while the resulting evaluation were used to obtain scenario for the intervening period of 1969 and the future projection for the period of 2013.

The composite map of the spatial distribution and areal coverage of the different land use types for the periods of 1969 and 20013 are presented in Figure 1,2 and 3 while the evaluated results is presented in Table: 1, 2 and 3.

Fig.1 imagery map of spatial distribution of the land-use type of 1969

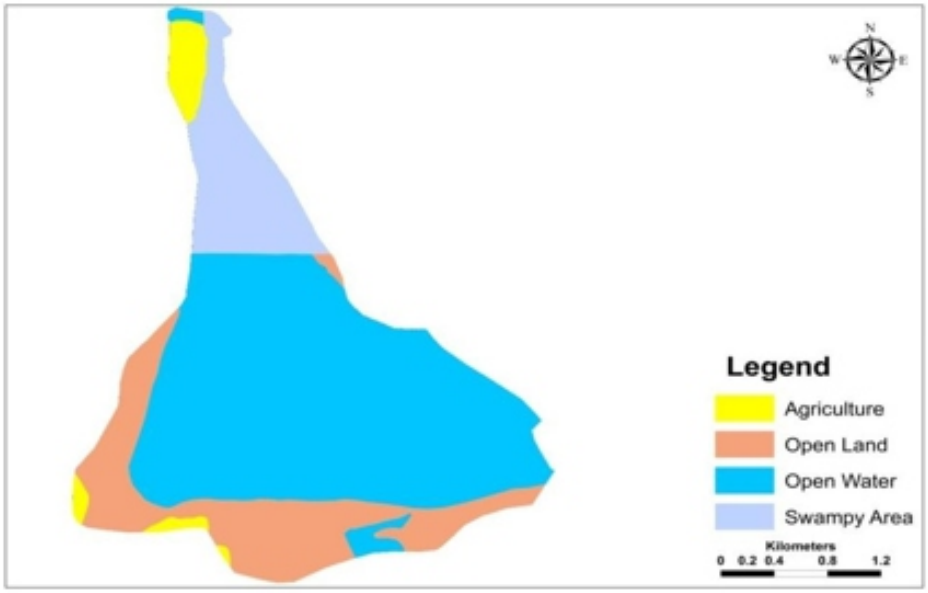

Fig. table1. Areas covered by different classes (1969)

S.NO	Class Name	TOTAL AREA Ha	year 1969
1	**Open Water**	**475.57967**	
2	**open land**	**154.89732**	
3	**Swampy area**	**96.177498**	
4	**agricultural land**	**27.635205**	
5	**plantation**	0	
6	**silt**	0	
7	**build up**	0	

As presented in Table 1, a critical interpretation and evaluation of the top sheet of 1969 revealed that the area of open water of Haigam Lake is about 475.57Ha, while the open land is about 154.89 ha, the swampy area of Haigam lake is about 96.17 ha and the total area of agricultural land is 27.63 ha and there is no build up and silt class in this image. The Haigam Lake shows little anthropogenic changes and the lake is in its naturalstate.

Land use and land cover image of 2011:

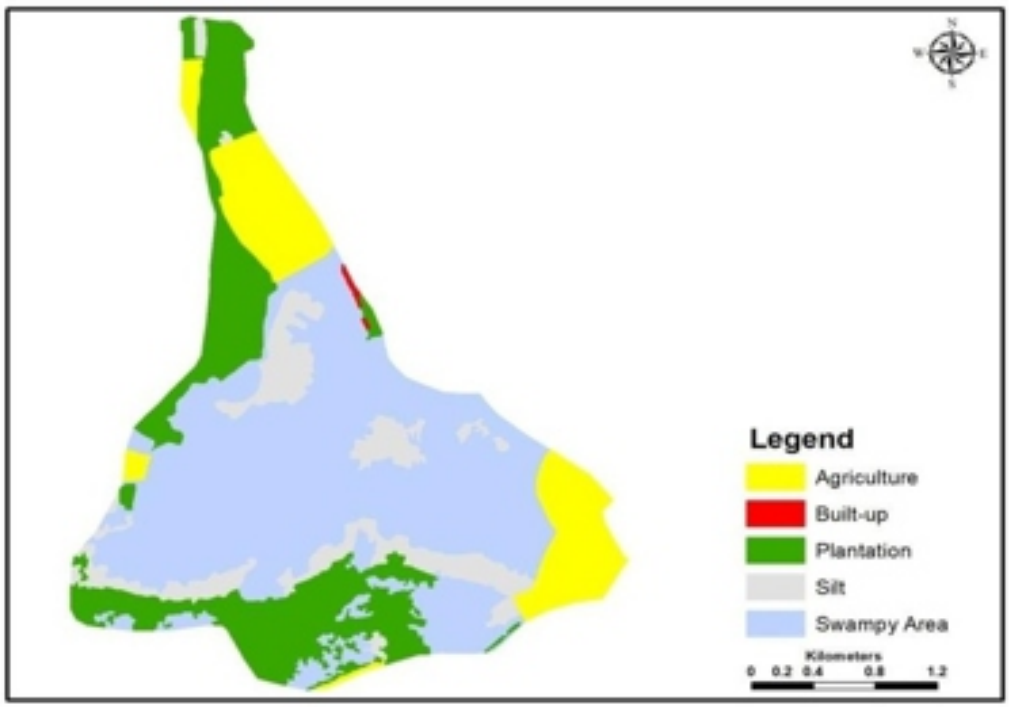

Fig.2 imagery map of spatial distribution of the land-use type of 2011

Fig. Table: 2. Areas covered by different classes (2011)

S.NO	Class Name	TOTAL AREA Ha	year 2011
1	**Swampy area**	**396.282176**	
2	**Plantation**	**168.381506**	
3	**agricultural land**	**103.343688**	
4	**Silt**	**84.878373**	
5	**build up**	**1.372909**	
6	**Open Water**	**0**	
7	**open land**	**0**	

Nonetheless, considerable impact of human activities within the Haigam catchment is reflected in the considerable decline in area of open water, the image clearly shows that the agricultural land has been increased from 27.63 ha to 103.34 ha and there is no build up class in 1969 which increased about 1.37 ha. There is also no siltation class seen in top sheet of 1969 with the passage of time siltation load is increased 0 ha (1969) - 84.87 ha (2011) (see Table2).

Land use and land cover image of 2013:

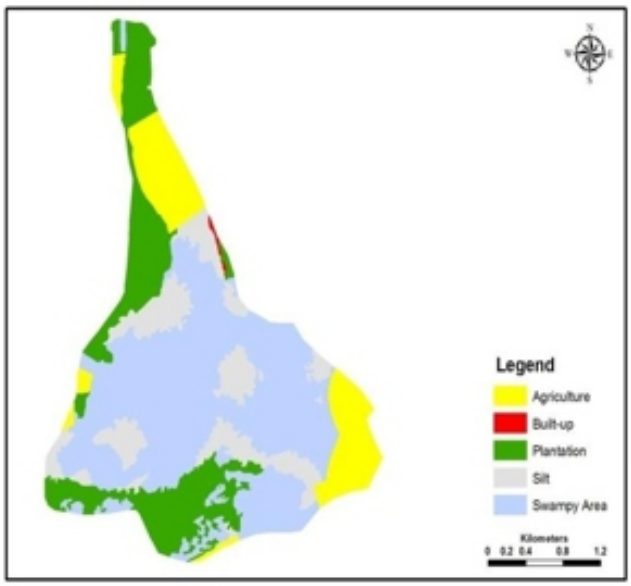

Fig.3: imagery map of spatial distribution of the land-use type of 2013

Fig. Table: 3. Areas covered by different classes (2013)

S.NO	Class Name	TOTAL AREA (Ha)	year 2013
1	**Swampy area**	**374.372988**	
2	**Plantation**	**159.226863**	
3	**silt**	**114.315355**	
4	**Agricultural land**	**105.005902**	
5	**Build up**	**1.407683**	
6	**Open Water**	**0**	
7	**open land**	**0**	

Furthermore, the temporal and spatial changes in land use pattern are clearly evident as highlighted in Table no.4 that shows that the open water and the total area both reduced with the agricultural and human settlement. The agricultural land increases from 103.34 ha (2011) to 105.00 ha (2013) and the buildup is increased from 1.37 ha (2011) to 1.40 ha (2013), while the silt load is also increased with the passage of time and increased from 84.87 ha (2011) to 114.31 ha (2014). The map 1.2 and the table no. 3 also show that the open water and open land reduces from 1969 to 2013 and this time there is no such classes seen in the image and remained as zero. If the same trend remains continue then time will come when the whole wetland is converted into human use and changed into non wetland use.

Fig. Table: 4. Comparison table of different years showing different classes and their total area

S.NO	Class Name	year 1969 T.A (Ha)	2011	2013
1	**plantation**	**0**	**168.381506**	**159.226863**
2	**Swampy area**	**96.177498**	**396.282176**	**374.372988**
3	**silt**	**0**	**84.878373**	**114.315355**
4	**agricultural land**	**27.635205**	**103.343688**	**105.005902**
5	**build up**	**0**	**1.372909**	**1.407683**
6	**Open Water**	**475.57967**	**0**	0
7	**open land**	**154.89732**	**0**	0

The plantation of Haigam Lake is zero in 1969 and the same increased from 0 ha- 168.38 ha and it reduces further due to the destruction of the same willow and other plantation by the humans and it remains only 159.22 ha.

The plantation in and around the Haigam Lake protects the lake from the siltation as it checks the water and absorbs most of the silt during flood and in the rainy season. The plantation is also a habitat of thousands of birds and some animals, but its destruction leads to the disappearances of hundreds of bird' s species and also the migratory birds flow reduces in this wetland. The main cause of the destruction of willow plantation from the Haigam Lake is due to the negligence of the conservation authority and the government himself, as the persons named the (RAKHS) meaning the persons who take care of the wetland takes money from the people and in turn gives him permission to destroy the plantation.

The open water is about 475.57ha (1969) and with the passage of time it reduces and converts into the swampy area and agricultural land. The reason of this conservation is the heavy silt load which makes the Haigam Lake shallow and covers the open water after that the aquatic vegetation increased and now there is no open water in this lake. The open water is habitat of thousands of migratory birds in the winter but now the wetland is visited by less migratory birds like ducks, mallard etc. the feeding channels and the destruction of the plantation around the catchment area and the expansion of the agricultural land results in heavy silt load into the Haigam lake.

DISTURBANCES AND THREATS:

Wetlands are disappearing throughout the world at an alarming rate. Loss of wetlands worldwide is estimated as 50% of those that existed since 1990 (Dugan, 1993; OECD, 1996) with most of the loss accounted from northern countries. Tropical and sub-tropical wetlands are increasingly being lost or degraded since 1950s through conversion to agriculture use. Agriculture is the principal cause for a total of 26% of wetland loss worldwide.

There are many threats to the Haigam wetland. The major problem is the increasing rate of siltation, Habitation and the agricultural land which has caused a noticeable deterioration in the wetland quality in recent years. Two factors contribute to this problem. First large-scale deforestation in the surrounding mountains has resulted in an increase in the silt load of water coming into the valley. Second, since most of the valley is agricultural land, there are fewer places for this silt to be deposited. Fertilizers' enter the lake as run-off, accelerating the rate of Eutrophication. Other threats include encroachment as more land is converted to rice paddy, and heavy grazing damages in some parts of the marsh.

Another threat from the human side is the reckless killing and poaching of migratory birds resulting in the loss of these birds. The Haigam wetland was considered as a game reserve and the local people use pellet guns and traps to capture and kill these migratory birds, who are visitors in this wetland. Another threat to these migratory and the local birds was the destruction of their nests by the removing of the macrophytic vegetation and the creed from the wetland by the local people and used as fodder for their cattle s.

The negligence of the government and the conservation authority of the Haigam wetland the wetland are shrinking both in area and the open water which are a habitat of thousands of migratory birds. The overuse of fish catching from the wetland by the surrounding people which decreases the fish population of the rivers and also in this wetland.

After massive encroachment, another threat faced by Haigam Wetland Conservation Reserve, an important wintering refuge for migratory waterfowls, shorebirds and trans-Himalayan species, is construction of a metalled road on one of its boundaries.

As on the spot visit revealed that construction of the road is going on from Akhnoonpora side of the Wetland. The road has been designed to connect Akhnoonpora with Gohal Tengpora and interior areas of Sopore. The spot on which the road is being constructed is actually an old bund, which helped to regulate water level in the wetland. “The authorities last year widened the bund with soil cover, saying it was necessary for its strength. Haigam Wetland which is included in Indian Bird Conservation Network on average. Construction of the road will wreak havoc on the wetland. There is already lot of human interference in the wetland by way of cultivation of paddy. After the road is constructed, the vehicular traffic on it will affect habitat of birds. I fail to understand how wildlife authorities are sitting silent on vandalization of the important wetland. The wildlife authorities did not take any action. It has been observed that migratory birds like to take refuge in adjoining wetlands around the Wular Lake including Haigam during daytime. If the road is allowed to be constructed, the birds will stop to visit the wetland due to noise of vehicles. The wetland is marred by various problems. Due to absence of any monitoring, the wetland has been turned into an animal farm with dozens of cows grazing in its breeding spots itself. According to experts, heavy grazing leads to destruction of breeding and feeding ground of birds. Moreover, there is no mechanism to regulate water level in the wetland as a result its waters keep draining out through breaches and conduits.

The major destruction occurred by the negligence of the govt. and the conservation authority which do not show any conservation efforts regarding to this wetland.

DISCUSSION:

Wetlands play a vital role in maintaining the overall cultural, economic and ecological health of the ecosystem, their fast pace of disappearance from the landscape is of great concern. The Wildlife Protection Act protects few of the ecologically sensitive regions whereas several wetlands are becoming an easy target for anthropogenic exploitation.

The Millennium Ecosystem Assessment Report (Millennium Ecosystem Assessment, 2005) highlights that in the last 50 years humans have changed ecosystems more rapidly and extensively than in any other period. This was done largely to meet growing demands for food, freshwater, timber, fiber and fuel. This resulted in a substantial and largely irreversible loss in diversity of life on earth, with 10-30% of the mammal, bird, and amphibian species currently threatened with extinction. The Living Planet Index, created by the World Wide Fund for Nature and the UNEP- World Conservation Monitoring Centre which provides a measure of the trends in more than 3,000 populations of 1,145 vertebrate species around the world showed that freshwater populations have declined consistently with an average decline of 50% between 1970 and 2000 (Loh et al; 2005).

Wetlands in India, as elsewhere are increasingly facing several anthropogenic pressures. Thus, the rapidly growing human population, large-scale changes in land use- land cover, burgeoning development projects and the improper use of watersheds has all caused a substantial decline of wetland resources of the country.

The findings of the present study indicate that landscape composition of Haigam wetland has been modified by human intervention. The results clearly show the negative impact of the humans on the Haigam wetland.

The open water of the Haigam Lake was 475.57 ha in 1969 but the same area was reduced and in 2013 it was 0% ha.

The open water is a dwelling place for the migratory birds who visited this wetland on winter seasons in large numbers. The reason of the decline of the open water was the uncontrolled flow of siltation and the destruction of the plantation. The plantation prevents the silt load as it prevents the flow of water and acts as a barrier for the silt. With the destruction of the plantation the water enters directly into the wetland and it reduces the deepness of the lake and finally the open water is covered by the aquatic vegetation and barren area.

Results show that the plantation in and around the Haigam wetland was 0% ha in 1969 but it increases as the local population plant the trees in and around the wetland and it is 168.38ha in 2011 and the same plantation cover decreases by the cutting of the trees by the local people and remained only 159.22 ha in 2013. The plantation protects the wetland as it slows down the silt in the Haigam wetland and this plantation is a habitat of hundreds of bird species. With the passage of time the same plantation is destroyed by changing this land into the Agricultural land and by the government employees named (Rakhs) are the people who are for the conservation of wetland, these people takes money from the people and in turn they give him permission to destroy the plantation in and around the Haigam wetland. The same plantation cover is reduced from 168.38 ha in 2011 to 159.22 ha in 2013.

With the destruction of the plantation the migratory and the local bird population decreases and it becomes grassland for the animals. The people living around the Haigam wetland use this area for cattle greasing, and the cattle' s destroy the further area of the wetland. Another reason for the destruction of this plantation is the use of the plantation as a fuel wood by the local people. Now the area of Haigam wetland is barren with scattered trees.

The silt load was 0% ha in 1969 and the same increased from 0 - 84.87ha in 2011 and it increases further and reached 114.31 ha in 2013. The reason was the cutting of the plantation of the catchment area which acts as a barrier and reduces the silt load.

However, the study shows that a great influx of heavy silt load into Haigam wetland from Bakhul and Ningli perennial Nallahs (streams) drains directly into the wetland. This heavy silt load has contributed to loss in the area of aquatic habitats of this landscape. If the same pace of silt concentration enters into the wetland then the time is near when the whole wetland is turned into the barren area and finally becomes ground for playing and the land for agriculture and habitation. Again, some processes e.g. siltation, settlements and agricultural lands has converted the wetland area into non-wetland land use types e.g. meadows in the landscape have been formed by filling of shallow water areas by sedimentation through feeder channels of wetland and through receding of water level. This seems to be reason that Haigam wetland still serves as a potential waterbird habitat and sustains a larger waterbird community because the extent of major aquatic plant communities; emergent vegetation, floating vegetation and submergent vegetation in Haigam wetland. Due to excessive siltation, habitation and agricultural lands in Haigam wetland, submergent vegetation has completely disappeared from the area. Absence of submergent vegetation could be attributed to a very heavy biotic pressure and more dependency of local people on wetland resources in Haigam wetland.

Haigam wetland reserve faces severe threat of siltation, agricultural, increased area of habitation and a high biotic pressure and a heavy dependency of local communities on its resources. This could be the reason that population of migratory waterbirds is low in Haigam wetland.

The agricultural land has increased from 27.63ha in 1969 and the same increased to 103.34 ha in 2011 and it increased further and reached to 105.00ha in 2013. The increasing area of the agricultural land clearly shows the dependency of the people on this wetland and the inattention of the conservation authorities like wildlife department and the government of the state.

Due to the negligence of the conservation authority the agricultural land increased day by day and the pesticides, herbicides and the use of fertilizers in the agricultural lands for crop productivity are washed down into the Haigam wetland which results in Eutrophication of this wetland. Results also show that the growing agricultural fields in Haigam wetland results in the loss of this wetland by reducing the area and makes less area for open water which are Habitat of many migratory birds. Result shows that the buildup area in and around the Haigam Lake was 0% in 1969, the same area was increased and reached to 1.37 ha in 2011 and it increased further and reached to the 1.40 ha in 2013.

The area of open land of Haigam wetland is 154.89 ha in 1969 which is filled by the water in the winter and rainy season and become a habitat for thousands of local birds and migratory birds. But the same open land is 0% in 2013. Due to the negligence of the wildlife department and the government of the state it is fully under the control of the local population who make this as their property and turns this land into residential, agricultural and the apple orchids and other purposes. Haigam wetland which is included in the Indian bird conservation network on an average receives nearly 300,000 migratory birds, ducks and waterfowl species. Being an important breeding site for the birds and refuge over a dozen species of shorebirds and several Trans-Himalayans species. But due to alleged callousness of officials of wildlife and other departments, farmers from the nearby the villages gradually started to encroach upon the wetland by cultivation of paddy, human settlement and orchids.

Another threat to the Haigam is the construction of the metalled road, the road is being constructed is actually an old bund, which helped to regulate water level in the wetland. " The authorities last year widened the bund with soil cover, saying it was necessary for its strength. Haigam Wetland which is included in Indian Bird Conservation Network on average receives nearly three lakh migratory birds, ducks and waterfowl species, making it a major attraction for tourists, locals and scientists. Construction of the road will wreak havoc on the wetland. " There is already lot of human interference in the wetland by way of cultivation of paddy. After the road is constructed, the vehicular traffic on it

will affect habitat of birds. I fail to understand how wildlife authorities are sitting silent on vandalization of the important wetland. The wildlife authorities did not take any action. It has been observed that migratory birds like to take refuge in adjoining wetlands around the Wular Lake including Haigam during daytime. If the road is allowed to be constructed, the birds will stop to visit the wetland due to noise of vehicles.

The human growing human settlements in and around the Haigam wetland is another threat to this wetland which results in the loss of this wetland.

Haigam wetlands provide conductive breeding habitats to some resident waterbird species in spring season, which usually starts from month of March to May in the Kashmir valley. Peatland and Willow Salix Alba plantation represent important breeding habitats in Haigam wetland.

The destruction of willow plantation in the Haigam wetland by the local people and the people living around this wetland for fuel wood and other purposes results in the destruction of the breeding grounds of these birds and finally the number of migratory birds becomes less.

Results suggest desiltation of the wetland through either dredging or digging in the wetland. This would consequently increase expanses of open water and other marshy habitats that would increase the potential of the wetland to sustain abundant waterbird communities. Further siltation of Hygam wetland can be prevented by diversion of Bakhul and Ningli flood channels to outside of the wetland. Furthermore, the application of proper soil and water conservation practices throughout the watersheds is of major importance.

Management should consider protection of these habitats in spring season. In Hygam wetland, it is essential to maintain discrete patches of tall emergent as nesting cover for breeding waterbirds, especially of Mallard Anas platyrhynchos which breeds only in wetlands of Kashmir in the entire Indian sub-continent.

The study has revealed that there are complex interactions between wetlands and the fringe society. A range of direct – use values on which the sustenance of local people surrounding Hygam wetland depends comes from this wetland. Local economy of these areas has benefited by wetland resource uses. The local populations have the right to access to resources of these wetlands and this access exists only for a period of three months in a year.

Larger families, less education and families with a large livestock population showed more wetland resource dependence. Harvesting of reeds was a common resource use in Haigam wetland and livestock grazing in this wetland. The continued exploitation of these wetland resources will consequently have an adverse effect on their long-term sustainability. Due to the fact that a large population surrounding these wetlands is uneducated and unemployed, cattle is an integral part of their economy. These are the reasons that these wetlands are being used especially to meet fodder requirements of livestock. Because the social and ecological sustainability of local communities and their well-being is linked to availability of wetland resources, other livelihood options like eco-tourism can be a good means of generating alternative employment opportunities and reducing pressure on wetlands. Further, increase in the level of education among locals, reduced family sizes and alternative fodder requirements for livestock of local people could help achieve sustainable and wise use of two wetland reserves. The peripherals of wetlands can be managed as grazing pastures and for cultivation of forage species for livestock and this can largely reduce the pressure on wetland resources.

The overall results highlight the negative impacts of the human-induced influence on the Haigam Wetland ecosystem through land-use and waste effluent discharges with attendant degradation / loss on one hand. On the other hand it also highlights the fact that wetland serves as purifier, buffer and sink for the dissolved contaminants from the feeding villages drainage water system. The overall implication of the study is that there is the need to control the increasing encroachment of farming and building activities around the Haigam wetland to avoid removal of the vegetation and degradation of the ecosystem. Hence, the study recommends the adoption of Integrated Water Resources and Environmental Management in order to ensure proper ecosystem functioning of such wetland and thus safeguarding the overall quality of the wetland ecosystem.

MANAGEMENT AND CONSERVATION:

Haigam wetland initially was a vast expanse of open grassland. It used to be a roosting place for the migratory birds of Wular Lake. However, later on it was taken over by Maharaja Hari Singh and it took the shape of a permanent water body when a peripheral bund was constructed around it. The villages at present surrounding the wetland are Infact the villages settled by the then Maharaja himself from far flung areas for labour work. These areas were managed by Twaza (Hospitality and Protocol) Directorate to serve as a venue providing sport for themselves and their distinguished guests. Thus an adequate coverage to land and water game birds and animals was provided, with strict enforcement of laws. After 1947, management of these reserves in Kashmir region reverted to Fisheries Directorate till 1954, when Dachigam, Cheshmashahi and Rajparian (Daksum) Rakhs were upgraded as Game

sanctuaries in 1951. The administration then passed successively to Forest Department, (1954-60), then Twaza Directorate (1960-64) and back to fisheries Directorate (1972 to ending 1977), during the course many areas were transferred to Forest Department for future forestry management. In 1978 the administration again resettled to Directorate of Game Preservation of Forest Department, which finally emerged as an independent Department of Wildlife Protection in 1982, with the extension of 18 to 43 protected areas both old and new in all the regions, giving a sudden boost of over 15,000 kms from 0.20% to 7.5% of total land surface in the state.

Management of the Haigam wetland should incorporate ideas and opinions of local people. When decisions affecting wetlands are made with inadequate knowledge of local people conservation programs are unlikely to be successful.

Hokersar wetland, Wular Lake and Dal Lake has been listed under National Wetlands Conservation Programme (Islam and Rahmani, 2008). The wetland has also been internationally designated as Ramsar site. In the light of results of present study, Haigam wetland also fulfills more than one criterion for qualification as a Ramsar site and deserves to be on the national priority list of wetlands of India.

CONSERVATION MEASURES TAKEN:

The entire wetland is protected as conservation reserve by the Department of Wildlife Protection, Jammu & Kashmir. Active measures have been taken to restrict siltation, to maintain areas of open water, and to prevent further encroachment of rice paddies and the human habitation. The state government of Jammu & Kashmir State has asked the central government to include Haigam Rakh in the National Wetland Conservation Programme.

CONSERVATION MEASURES PROPOSED:

Existing management policies will be continued and waterfowl hunting will be maintained at a regulated level. Increasing attention will be given in controlling encroachment, particularly the conversion of marginal areas to rice paddy. Plans include:

(a) The erection of a barbed wire fence around the lake to prevent further encroachment;

(b) The diversion of the Bakhul flood channel to minimize the silt load entering the lake;

© The construction of a sluice gate.

CONCLUSION AND SUGGESTIONS:

The goal of this research was to see the impact of anthropogenic activities on Haigam wetland and develop a future plan for its conservation by using remote sensing and GIS. Wetland landscape has been analyzed. The results show that the total area has been reduced by converting it into agriculture land, habitation, orchids, vegetables gardens and the silt load drastically from 1969 to 2013. The total areas of open water in 1969 were 475.57 ha and it reduced drastically with the passage of time and remains 0 ha in 2103, which also reduces the flow of migratory birds in winter season and also the habitat of thousands of local aquatic species are destroyed.

In short the total area f Haigam wetland reduced greatly from 754.32 ha in 1969 and remains only to 533.60 ha in 2013 due the conservation by human activities like agricultural activities, human settlements and the siltation.

Conservation steps taken are not enough; wildlife conservation authorities and the Government should take their responsibility if they want to preserve the Haigam wetland for further destruction. The funds giving by the govt. should be utilized properly and a proper conservation plan should be prepared and followed. The awareness of the local villagers and the youth towards the wetland will help the wild life conservation to prevent the wetland, seminars, discussions and the importance about the wetland should be given so that the people know the importance of the Haigam wetland.

It is noteworthy that even a small country like UK could designate 161 wetlands as Ramsar sites, India being a mega-diversity country, so far managed to delineate a mere six sites till date.

SUGGESTIONS:

After studying the wetland results shows the negative impact of humans on the Haigam wetland, the following suggestions should be done to protect the beautiful wetland which is habitat of thousands of local and the migratory birds, fishes and the aquatic life.

1. Protect Wetlands Locally:

Local governments and the wildlife conservation authority play a key role in filling the gaps in wetland protection if they understand their duties regarding the Haigam wetland, because they have primary responsibility for local land use management. Prevent of grazing, overfishing, killing of migratory birds, siltation and the cutting of the trees in the Haigam wetland are the responsibility of the Haigam conservation authority.

2. Buffers and Greenbelts:

Perhaps the most effective management practice to protect Haigam wetland from adjacent human activities is to establish and maintain a vegetative buffer (or greenbelt) around the wetland. A greenbelt is simply a strip of plantation which covers the wetland.

Fencing:

As now there remains only a small portion of Haigam wetland and the major area of this wetland is covered by the human purposes. Fencing is one of the simplest ways to protect the remaining area of Haigam wetland. Even if you can't fence all of your wetland, you can often fence off overused places where extra protection is necessary. There are several things to consider when determining what fencing is best for you.

Fertilizers and Pesticides:

The catchment areas agricultural fields are a serious threat to the Haigam wetland as the pesticides, herbicides and the chemical fertilizers used for crop production are directly drain into this wetland which pose a serious threat to the aquatic flora and fauna of this wetland.

3. Recreational Use:

Haigam wetland is one of the most beautiful wetlands in Kashmir, but due to negligence of the conservation authority the wetland is degraded fast. This wetland should be converted for recreational purposes, so that it become a hub for touristic visit and also a income for the surrounding villages, who are totally depend on this wetland.

4. Banning on conversion of wetland into agricultural lands:

The Haigam wetland is continuously changed into agricultural fields as shown clearly in the results. Some people illegally grab most of wetland land. These activities should be banned if conservation authority wants to protect the wetland.

5. Diversion of the major Flood channels of Bakhul and Ningal:

The Bakhul and the Ningal are the two channels which directly drain into the Haigam wetland. These rivers are responsible for the major siltation load into the wetland. To protect the Haigam wetland from siltation from these rivers a diversion is required so that the water is not directly drain into the wetland.

6. Awareness camp should be organized for the local people and the surrounding catchment areas about the importance of the wetlands.

7. Results suggest desiltation of the wetland through either dredging or digging in the wetland. This would consequently increase expanses of open water and other marshy habitats that would increase the potential of the wetland to sustain abundant water bird communities.

8. Yearly conservation measures should be revived at the end so that it may know how much area is increased under the control of the local population. So that it may help to protect the area.

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2. Survey paper (giving an original, detailed and critical view of a research problem or an area to which the author has made a contribution visible through his self-citation);

3. Short or preliminary communication (original management paper of full format but of a smaller extent or of a preliminary character);

4. Scientific critique or forum (discussion on a particular scientific topic, based exclusively on management argumentation) and commentaries. Exceptionally, in particular areas, a scientific paper in the Journal can be in a form of a monograph or a critical edition of scientific data (historical, archival, lexicographic, bibliographic, data survey, etc.) which were unknown or hardly accessible for scientific research.

Professional articles:

1. Professional paper (contribution offering experience useful for improvement of professional practice but not necessarily based on scientific methods);
2. Informative contribution (editorial, commentary, etc.);
3. Review (of a book, software, case study, scientific event, etc.)

Language

The article should be in English. The grammar and style of the article should be of good quality. The systematized text should be without abbreviations (except standard ones). All measurements must be in SI units. The sequence of formulae is denoted in Arabic numerals in parentheses on the right-hand side.

Abstract and Summary

An abstract is a concise informative presentation of the article content for fast and accurate Evaluation of its relevance. It is both in the Editorial Office's and the author's best interest for an abstract to contain terms often used for indexing and article search. The abstract describes the purpose of the study and the methods, outlines the findings and state the conclusions. A 100- to 250-Word abstract should be placed between the title and the keywords with the body text to follow. Besides an abstract are advised to have a summary in English, at the end of the article, after the Reference list. The summary should be structured and long up to 1/10 of the article length (it is more extensive than the abstract).

Keywords

Keywords are terms or phrases showing adequately the article content for indexing and search purposes. They should be allocated heaving in mind widely accepted international sources (index, dictionary or thesaurus), such as the Web of Science keyword list for science in general. The higher their usage frequency is the better. Up to 10 keywords immediately follow the abstract and the summary, in respective languages.

Acknowledgements

The name and the number of the project or programmed within which the article was realized is given in a separate note at the bottom of the first page together with the name of the institution which financially supported the project or programmed.

Tables and Illustrations

All the captions should be in the original language as well as in English, together with the texts in illustrations if possible. Tables are typed in the same style as the text and are denoted by numerals at the top. Photographs and drawings, placed appropriately in the text, should be clear, precise and suitable for reproduction. Drawings should be created in Word or Corel.

Citation in the Text

Citation in the text must be uniform. When citing references in the text, use the reference number set in square brackets from the Reference list at the end of the article.

Footnotes

Footnotes are given at the bottom of the page with the text they refer to. They can contain less relevant details, additional explanations or used sources (e.g. scientific material, manuals). They cannot replace the cited literature.
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