# CROSS-LAYER DESIGN FOR WIRELESS SENSOR NETWORKS USING COOPERATIVE ROUTING AND LINK ALLOCATION

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**ABSTRACT**

In detector networks, energy and data live are both limited resources. In an effort to increase detector network lives, the energy economical routing downside has previously been thoroughly researched, but the link system of measurement has been overly optimistically assumed to be abundant. Energy constraints have an impact on data routing, link measurement systems have an impact on each link's allowable rate as well as the routing topology, which has an impact on life. Previous studies that concentrate on energy-efficient operations in detector networks with the "only real" goal of extending network life only consider the energy limitation while disregarding the data live constraint. This study demonstrates how unrealistic these solutions could become whenever a measurement system imposes a restriction. It offers a brand-new mathematical framework that considers all energy and data life constraints and suggests two cost-effective algorithms for rate allocation and routing. Simulation findings demonstrate that these algorithms considerably enhance the product and offer more feasible routing solutions than prior studies. a technique for distributing the range that the provided link rates support is granted. The cross-layer design technique completely resolves the hidden terminal and exposed terminal issues while improving channel maximization noticeably.

**INTRODUCTION**

Introduction The sensing element could be a cheap, low-power gadget that reacts to physical information (like heat, light, sound, pressure, magnetic, or a specific motion), transmits a corresponding impulse (for measurement or control), and then encodes these in a format that can be understood by humans. This can be useful in terms of mobility and readiness, but it also restricts the sensors' processing and storage speeds. A wireless sensing element network (WSN) is a collection of physically dispersed autonomous sensors. Sensing element nodes are responsible for self-organizing a sufficient specification after the initial (often ad hoc) preparation, which typically entails multi-hop connections between sensing element nodes. A base station connects the sensing element network to another network (like a gateway) to distribute the information decided for additional processes. The information flow entails a pause at these specialized nodes, which are also frequently referred to as sinks. Base stations must perform complex processing, so they require more capabilities than simple sensing element nodes. This justifies the use of processors in the workstation/laptop category, as well as sufficient memory, energy, storage, and procedure capability to carry out their tasks. even though processor design and computation have greatly improved The primary disadvantage of wireless sensing element networks is that battery technology advancements have lagged. In order to analyse the performance limits of wireless sensing element networks, good analysis attempts have been established. Performance limits include things like network capacity and network duration. the maximum amount of data volume that each node in the network will successfully send to the base station (also known as a "sink node"), whereas network lifespan is the maximum amount of time that nodes in the network will remain active before one or more nodes run out of power.

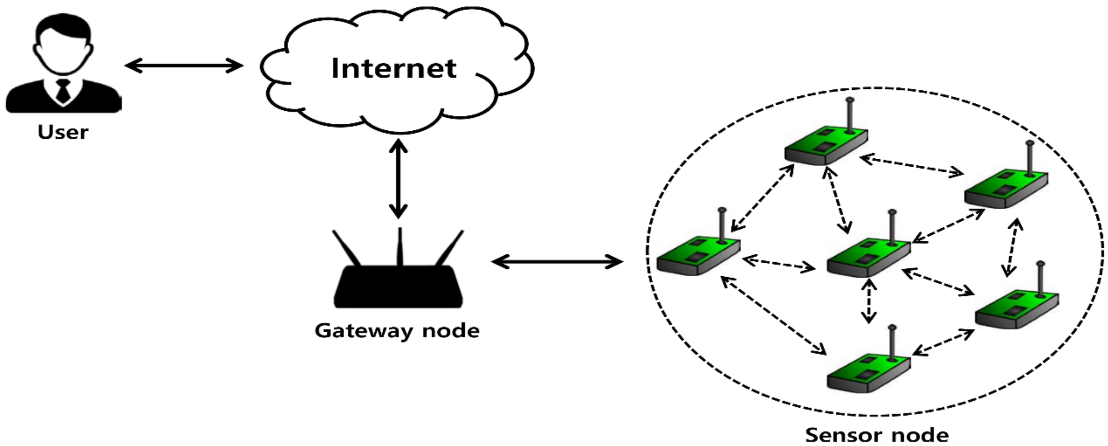


**Fig: WIRELESS SENSOR NETWORK**

**OVERVIEW OF MAIN CONTRIBUTION**

The joint and routed link allocation problem is examined in this paper with the goal of maximizing life and output while considering the restrictions on energy and information measures. The second stage deals with how to assign time slots using the link rates that are provided. In an effort to achieve the goal of a world without conflict, a method for assigning the interval on a given link rate has been created. I examine the necessary and redundant conditions for the joint routing and link allocation disadvantage. Two heuristics are devised for the most time-consuming problem and the mathematical model is provided. Results using the previous techniques and these two heuristics . In order to determine whether algorithmic programmed is more cost-effective, (MaxLife and SPR) are compared. Additionally, the maximum result was taken into consideration. Two heuristics, Heuristic III and Heuristic IV, are created using the new mathematical model that has been presented. In an effort to create a timetable without conflicts, the method for assigning the interval is designed based on the connection rates attained using Heuristics I and II. And these are a few check instances to ensure the algorithmic programmed is correct.

**LITERATURE SURVEY**

According to the energy and information measure restrictions, this study considers the joint and routing link allocation problem's ideal solution in order to maximize life and output. The second stage deals with how to assign time slots using the link rates that are provided. In an effort to achieve a world devoid of conflict, a method for distributing the time interval on a given link rate has been created. I examine the necessary and sufficient requirements for the joint routing and link allocation drawback. Two heuristics are proposed for the solution of the maximum life time problem using the mathematical model that has been provided and outcomes using the earlier methods and these two heuristics. In order to determine whether algorithmic programmed is more cost-effective, (MaxLife and SPR) are compared. Additionally, the maximum result was taken into consideration. Two heuristics, Heuristic III and Heuristic IV, are created using the new mathematical model that has been presented. Considering the victimization link rates To achieve a timetable free of conflicts, heuristics I and II, the time distribution approach, are devised. And some of these examine examples in order to validate the algorithmic programmed.

**RELATED WORK**

The most relevant works are one paper from our earlier work on edge colouring for transmission scheduling [1 J] and one study by Lall et al. [f 2]. The authors of [1] correctly portrayed the relationship between transmission conflict and time slots at the MAC layer by matching each hue to a certain time slot. Time slot assignment is guaranteed to be conflict-free if each edge has the same load. Contrarily, edge coloring is NP Complete and assigns one colour to each edge, suggesting that it performs best under conditions of constant traffic demands. In this article, link rate assignment is a continuation of color assignment. The quantity of time slots each edge receives is proportional to the traffic load on the edge, and we also take into consideration the energy limits of the nodes, so it works well for arbitrary traffic loads.In order to maximise network lifespan, the authors of [2] suggested a distributed method for determining connection rates.

**CONCLUSION AND FUTURE WORK**

In this study, a general mathematical model for the best routing in a sensor network with constrained energy and bandwidth is presented. Energy as the only constraint can result in impractical solutions that the link's capacity cannot support. This study investigated the prerequisites for a specific traffic load to flow through a network as well as how to optimise bandwidth utilisation and energy consumption. Based on a mathematical model, we develop two heuristics (Heuristic I and Heuristic II) and compare them against two other algorithms (MaxLife and SPT) in order to determine which produces the best results. The solution not only provides the routing topology but also details how much information should be sent along each path. The joint optimisation makes sure that the designated routing solution is supported by a time slot assignment that is free of conflicts. We offer an algorithm for allocating time slots to create a global timetable free of conflicts based on the link rate. The test case demonstrates that it is possible to obtain a schedule devoid of conflicts. Finally, we analyse the total throughput of two different heuristics while assuming that any node except the sink may send data out. According to our knowledge, this is the first attempt to explicitly consider bandwidth restrictions when addressing a maximum lifespan routing problem in Senor network with any architecture We'll complete the time slot assignment algorithm in the future and develop a bigger test case to verify it. Right now, we only have a few straightforward test cases, but they show how well this method works. We'll run some more challenging tests on this method.

A node can take three packets but can only send out one aggregated packet if flow conservation is not maintained. This is why connection rate allocation is important for data aggregation. In this situation, we must once more create a solution that maximises throughput and life. Additionally, we'll develop some test cases to verify them.

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