Optimization of Resources for Wireless Network Control System Based on Sending Control Strategy

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ABSTRACT

This paper studies the wireless network control system, describes the current situation of wireless network control system and describes the general approach to optimize the network. Then put forward the resources to optimize the design of wireless network control system. Build a system model, and establish the corresponding scheduling problem, and achieve optimal design. Through validate with the results from optimization design by simulation. The results show that the estimation performance optimization algorithm liberal radio network control system designed in this paper is better than the best TDMA strategy.

Keywords: wireless, network, optimization, algorithm.

Overview

With embedded technology advances, Wireless node reliability has been enhanced, cost reduction. For the deployment of wireless networked control systems provides a good guarantee. Wireless network control technology being used for domestic and military industrial technology of choice. In the industrial field, smart buildings, smart grid-building construction, forestry, ecological monitoring, and robot control, application of wireless networked...
control system has a larger space. Wireless networked control system with easy deployment, easy expansion, low cost, environmentally-friendly and high redundancy benefits. Existing research, wireless networked control systems with controlled consistency, collaborative work, and reliability and security is facing enormous challenges, and deploy a wireless networked control systems when the specific algorithm for distributed computing is also a problem to be solved. Wireless network control technology related research once there, attracted a large number of scholars and the team's concerns, respectively, involving communications, networking, computer and control more than one technology area, and has yielded a wealth of research results.

Optimization for resources of General network

Under wireless communication network unreliability, results in even one on one network and its optimization of system resources also have considerable difficulty. On specific factors, packet loss, and latency is the most unreliable of two parameters, for single-loop control systems with different State and its State estimation and control parameters of a method in a different model.

Current network system in General, there may exist many multi-hop routes or multiple loops, and communication are interfered with by, the system has a certain complexity. Therefore, optimization of resources in the current study, are generally optimized for network topology and latency. Blind in the study of event-triggered control methods in the standard under this two-minute Aloha Aloha and analyze the performance, comparative study, found that time Aloha Aloha network performance is better than the standard network protocol agreement performance. Remesh and Sorooshyari are taken into account in the study of control system of communications, communication capability as the best State, will send data, and implement dynamic energy control. Design phase of the transmitted power and interference of the actual relationship.

In large-scale wireless network control system, because the communication and computation of each node is large, thus leading to the study of cells and endurance to become an important research direction. And the current node typically has a sleep setting, and thus to optimize battery life, usually to wake-up and the sleep time point is controlled so as to realize optimization. Such as the operating mode of a node is in a specific time period, only two defined time points the system is in the awake state, all the rest of the time the sleep state. If a node can get more sleep time, so you can maximize conserve battery power, improve endurance. Many scholars designed the corresponding control protocol, which mostly dormant adaptive mechanisms.

The wireless network resource optimization design control systems

In this paper, the wireless network control system resource optimization optimization reflected in the presence of channel interference condition sensor sends strategy. In the application in order to achieve a high control
performance, then you need to get to the object to be controlled relatively accurate estimates. Because the presence of Wi-Fi channel interference, then the estimates would be affected to some degree. To convert the data reception capacity of each link transmission coefficient to the sensor. Proposed embodiments estimation control and better use of the communication channel. With two sensors and two receivers for four node wireless network, in different circumstances to send the case to optimize the effectiveness of simulation by this sub-optimal design.

**System Model**

A wireless network control system must research topic is the state estimate, which is the most important and difficult to optimize the design. In order to get a more accurate estimate of the state, which requires enhanced anti-jamming ability to communicate and improve reliability. System Model

This article is not a single sensor for communicating status verification, but a plurality of sensors are carried on the distal end of estimation, optimization coordinated transmission capability of each sensor, to achieve efficient use of the channel, so as to realize the accuracy of the estimation accuracy.

After the system model is built, the need to establish radio channel propagation model. In the wireless channel data, resulting in data loss or data is not successfully received three main reasons: first, the data in the transmission process, the signal weak; second reflection, buildings and the like on the conveying path and signal absorption; interference third, other signals and the like. Studies have shown, because the receiving end while receiving a plurality of nodes of the communication request.

**Establish a scheduling problem**

The purpose of establishing the model is to allow all remote estimate is relatively accurate estimates. Then you need to estimate the error variance to express this level of precision. Establishing a time of the sensor receiving end estimation error covariance.

If at a certain moment one extreme, all nodes are sent to the receiving data, then each of the receiver will be subject to a large number of signal interference, which directly causes the packet reception rate is lowered, can not accurately estimate the overall performance. To prevent this from happening, we need to establish an optimal strategy, execute strategy relies dynamic interference between the various sensor nodes decision. Node can decide for themselves whether to send estimates, scheduling issues to be established in this article is to achieve an optimal sensor transmission scheme.

**Wireless network control system**

This article is to be achieved by a closed-loop control strategy optimization model based on the optimal design of the sensor sends strategies. Policy-based
The control loop optimization model of the core idea is to combine the dynamic model can predict the impending situation, ongoing optimization, and implementation cycle, constantly correcting errors and achieve control role model. Assuming that at some point, any time a node receives a packet success rate:

\[ \alpha_i(K) = [1 - \frac{1}{2} Q(\sqrt{P_i(K)})] \]

(1)

So, at any point in time on the node expectation error covariance estimate is:

\[ E[\bar{P}_i(K + 1)] = \alpha_i(K + 1)P_i^* + (1 - \alpha_i(K + 1))h(\bar{P}_i(K)) \]

(2)

Control loop optimization strategy based on specific yard, the next moment, the optimal solution for system:

\[ J_{K+1-K+T}(\theta_{K+1-K+T}) = \frac{1}{T} \sum_{k=K+1}^{N_T} \sum_{m=1}^{M} \rho Tr(E[\bar{P}_i(k)]) \]

(3)

Then the optimal strategy is from K + 1 to K + T been period, starting from the K + 2, the above operation is repeated optimal solution method, we get the most transmission policy for the particular time period.

Simulation

Through the establishment of a power analysis to the two sensor system as the basic system, were added to the design of new nodes and two nodes transmit sensor synergy, two nodes can send their own control strategies. This article is designed experiments to verify resource wireless network control system designed to optimize the performance of the proposed strategy is sent through.

Assume that the system parameters of the dynamic process is as follows:

\[ A = \begin{bmatrix} 1.2 & 1 \\ 0 & 1.1 \end{bmatrix}, \quad Q = \begin{bmatrix} 0.3 & 0 \\ 0.1 & 0.2 \end{bmatrix} \]

Sensor nodes measuring parameters are as follows:

\[ C_1 = \begin{bmatrix} 1.5 & 0.6 \\ 0 & 1 \end{bmatrix}, \quad C_2 = \begin{bmatrix} 0.9 & 0.5 \\ 0.8 & 1.2 \end{bmatrix}, \quad R_1 = \begin{bmatrix} 0.2 & 0.1 \\ 0.1 & 0.3 \end{bmatrix}, \quad R_2 = \begin{bmatrix} 0.2 & 0.1 \\ 0.1 & 0.3 \end{bmatrix} \]

Design right weight coefficients were 0.3 and 1, and the rest of the data model and parameters exactly as standard. Experimental results are shown in figure 1 and 2:

![Figure 1. Receiver of the estimation error covariance and changes of Synergy sends the policy.](image-url)
As can be seen from Figure 1, since the operation mode TDMA transmission policy, the estimation error covariance is showing changes periodically. Cooperative transmission policy changes were random curve graphic sex, in general, it is estimated the line cooperative transmit strategy is significantly lower than TDMA transmission policy. It can be seen from Figure 2, S2 node selection time data is not transmitted significantly less, since the weight coefficient matter larger than S2 design S1. S2 only in the first node 69 does not perform data transmission time period, corresponding to the same time segment in Figure 1, we can see that, in this case, the maximum error covariance of the time period, the next time the error covariance as S2 in the send tactics changing moment, along with significantly reduced. The above experimental results it can be seen, cooperative transmission policy has better overall performance and better compared to TDMA channel utilization policy.

Summary

This paper studies on the wireless network control system resource optimization methods, mainly by sending resource optimization strategy design and implementation. The actual use of the transmission channel model, the acceptance of the road, such as packet and SINR control and research, propose optimizations based model predictive control. Respectively, from the two scenes experimental verification, the experimental results indicate the estimated performance of the algorithm is better than the best TDMA strategy.

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