ISSN: 2348 - 2117

International Journal of Engineering Technology and Computer Research (IJETCR)
Available Online at www.ijetcr.org
Volume 3; Issue 5; September-October-2015; Page No. 01-04

CONGESTION CONTROL ALGORITHM WITH MATLAB SIMULATION FOR AGRICULTURAL MODEL EMPLOYING WIRELESS SENSOR NETWORKS

ABHISHEK SINGH[1], RASHID HUSSAIN[2]

[1]M. Tech (Digital & Wireless Communication Engineering), GVSET, Jaipur (Rajasthan)

[2]Associate professor, GVSET, Jaipur (Rajasthan)

Abstract

As we know, our economy depends over agriculture and there are a lot of methods in order of savings. Wireless Sensor Networking is also used over very heavily in agricultural activities in India to save water, increase productivity, etc. In this there leads an issue with congestion when a lot of data transfer takes place and it should be handled over necessarily. In this paper, an algorithm has been explained over in order to handle congestion control over an agricultural model made under consideration of various parameters in a greenhouse.

Keywords: WSN, Congestion control, AIMD.

1. INTRODUCTION

1.1 WSN in agriculture: India being a developing country has second highest agricultural land to be cultivated. Majority of population totally depends over employment in agricultural sector. There are a number of issues to be controlled over in agriculture. The biggest issue in agricultural sector is water management and productivity. Indian irrigation system totally depends upon rain. It is highly affected by decrease in the amount of expected rain and water management. Therefore, system can't be dependent over rain in terms of irrigation. For this, there should be usage of technology in irrigation system to increase productivity and make it profitable. Further, WSN is used over in agricultural activities for various purposes. WSN stands for Wireless Sensor Network. [1] In the system, a gateway is incorporated which provides unwired connectivity to the distributed form of nodes. The data obtained in this procedure is carried over to gateway node. The location of the sink node affects consumption of energy and lifetime. In this technology, real-time can be accessed remotely and further analysis is done over followed by a real-time reaction taken over it. It enables completely newer capability to control and measures applications due to communication wirelessly. Long term monitoring applications have improved reliability by eliminating lead wires which also leads to savings in terms of cost. WSN represents technology for measurement and control applications with low-power. Basically, it helps with the calculation of water requirements during crop growth. The field conditions can be monitored in real-time. This helps to overcome the problem instantly and get decision over various parameters. This can be illustrated to illiterate farmers by the usage of maps and graphs by the professionals or researchers. There is various simulation models available related to agriculture. [2]

Implementation of WSN system can be done for grain depot in order to monitor humidity and temperature including storage, collection of data, transmission, etc. with stable performance. [3] In terms of networking theory, the process of deterioration of quality of services during excess of data carried over a node is termed as congestion. It leads to the delay, connection blocking or losses in packets. There are various control and avoidance techniques which are used over for this problem. Also priority schemes are implemented over in order to reduce it. It concerns handling traffic ingress in telecommunication network. WSN is implemented over information and control in agriculture as applicative area. Implementation is hold over with using MATLAB software. Quicker response has been marked upon climatic conditions under this consideration. [4]

1.2 Congestion control: In order to avoid congestive collapse, oversubscription of any process of nodes which are intermediate and network is avoided like reduction of rate over sending of packets of data. The application of convex optimisation and microeconomic theory described the concept of congestion control. The type of flow has higher importance than that of application in terms of guidance to real congestion control. It includes single, fewer and many packets format which are to be needed with control on their level. The flows cross when many nodes transmit information, at the intermediate nodes. A large number of sources increase congestion while on the other hand helps over in improvement of

Corresponding author: ABHISHEK SINGH

reliability. The area across the point of intersection goes to be a hotspot which leads to buffer overflow and links interference. Because of this, an algorithm over congestion control must be there for data packet transmission. The mechanism to be followed up for congestion control should be as congestion notification, network scheduler and Congestion avoidance algorithm. [5]

The process of congestion control is categorised over basis of contention and buffer. There are three steps to be followed up for functioning as congestion detection strategies, congestion notification and congestion control. It goes with detection of congestion by various strategies dependent over relative parameters followed by notification of congestion. [6] Then, any of congestion avoidance mechanism is applied over the link as required by the conditions. There are some algorithms for controlling congestion which are designed across MAC and transport layers in order to achieve better efficiency. The cross layer design helps in minimizing end-to-end delay. On dependency over control policy transport protocols are divided as resource control and traffic control techniques. In concept of congestion control, there must be format for evaluation. It must be done in order to show efficiency in the purpose with in having overload traffic. It goes with metrics which are used in some protocols to achieve evaluation. The most common among them are network fairness, energy efficiency, sink received throughput, packet latency, etc.

2. Proposed congestion control Algorithm

In this paper, an algorithm has been proposed in order to get fair and efficient congestion control. This algorithm is for a simple network which consists of a single link with unit capacity. Further, it goes with AIMD law and also with fixed capacity over the network. The algorithm clarifies many of the basic features. It holds concept of equilibrium point at a stage in the process.

Initially, congestion control problem is abstracted by presentation of a network having single link with fixed capacity to be shared by two sources. In this, AIMD (Additive increase Multiplicative decrease) law is used so as to adapt the transmission rate to feedback from network in order to check either the link is congested or not, of two sources leads to equilibrium. Congestion will occur when the link access rate goes more than link capacity. It's common as when accessing goes more than capacity of link, it would create congestion automatically. The algorithm is operated over by steering of network towards an operation point corresponding to stable equilibrium.

2.1 Assumptions: Let us suppose condition for two sources on a single link. It is with capacity C (packets/sec). Suppose A_i be rate of packet transmission into network for i=1, 2. Feedback is provided to sources in order to indicate either total excess rate ($A_1 + A_2$) exceeds capacity of link C or not. Congestion occurs as the situation arrives when accessing rate of link crosses link capacity. Feedback signal is represented by I ($A_1 + A_2 > C$) where, ($A_1 + A_2 > C$) is indicator function of event. The value is taken as 1 when event is true otherwise 0 when it is false. The purpose is of sharing link by sources must be fair. It should be fully utilised in respect to convergence of transmitting rates of sources at an operation point which is stable. This is used in realization of unique equilibrium for network. Transmission rates are adjusted in accordance with a particular differential equation with concept as if total receiving rate at link is less than capacity C, then transmitting rate is additive increased by a source and if it is more than Capacity C, then it goes under multiplicative decrease. This concept is known as additive increase and multiplicative decrease law. [7] Both of events are said to be complimentary as only one can occur at a time. Here, resources are dynamically allocated which is fundamental in derivation of packet switching in terms of benefits. An algorithm should support fairness in allocation of rates to several users with providing a rate region as large as possible. Each of sources uses a single bit feedback over network and they don't need to communicate each other.

The experiment requires equilibrium convergence behaviour for differential equation. It is done by using MATLAB. Initially, discretization of differential equation has been done over to get difference equation which is further implemented in MATLAB. [8]
The final equation obtained is as follows:

$$A(k+1) = A(k) + \alpha\,\delta\, I(A_1 + A_2 \le C) - \beta\,\delta\, A_i\, I(A_1 + A_2 > C)$$

Finally, it is implemented over in MATLAB and equilibrium convergence behaviour is achieved as result in plot. It is confirmed totally that link is totally utilised at equilibrium and equal sharing takes place by all users.

3. MATLAB Implementation

Initially fixed values are C=1, $\alpha = 1$ and suppose $\beta = 0.5$, $\delta = 0.05$ for this case. Further, we will go for both of the conditions as additive increase and multiplicative decrease. This can be done by changing the values of rates of both of the sources to get applied over for the conditions.

3.1 Additive Increase Condition

Now, let $A_1 = 0.2$ and $A_2 = 0.1$
Then, $A_1 + A_2 = 0.2 + 0.1 = 0.3 < C$

So, $A_1 + A_2 \leq C$ and the condition is followed up and the equilibrium point is obtained at $A_1 = 0.5$ and $A_2 = 0.5$ as shown in the graph plot. So, (0.5, 0.5) may be considered as the equilibrium for the condition where both of the sources are sharing the link equally which is having capacity C = 1. This is both fair and efficient for congestion control issue.

This is the condition where $A_1 + A_2 \leq C$, so as per AIMD law there must take place additive increase which can be seen in the plot obtained.

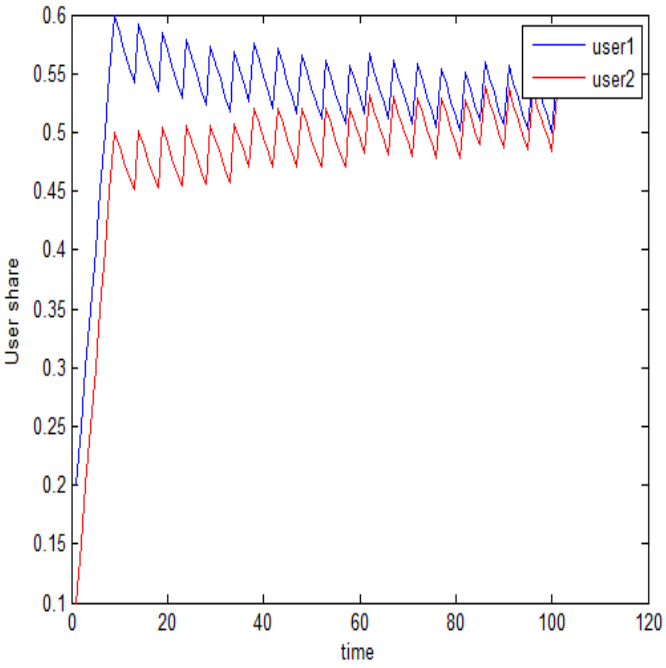

Fig 1: Additive Increase plot

Further, it can be observed also by changing the values of the rates of both of the sources in the MATLAB code.

3.2 Multiplicative Decrease condition

Now, let's go to the other condition over where $A_1 + A_2 > C$ must be followed as per the values of the sources. Initially fixed values will be the same and values of sources will be changed.

Let, $A_1 = 0.7$ and $A_2 = 0.5$

Then, $A_1 + A_2 = 0.7 + 0.5 = 1.2 > C$

So, the condition of $A_1 + A_2 > C$ is followed up and there must be multiplicative decrease in the plot of time vs users share. It can be seen in the plot shown below.

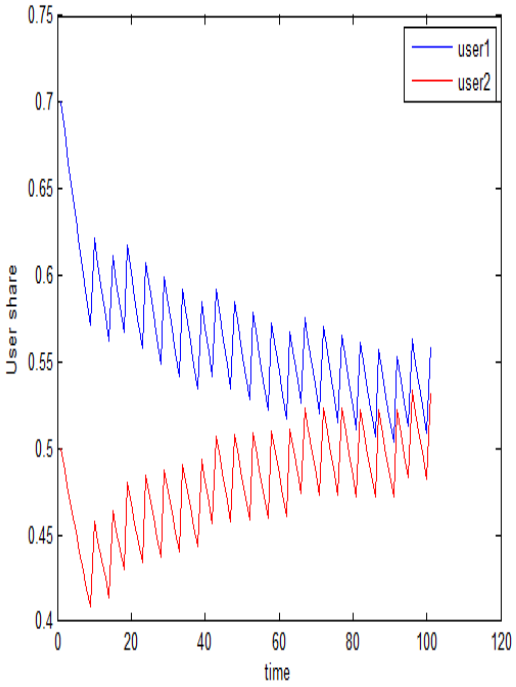

Fig 2: Multiplicative Decrease plot

Again, different plots can be observed by changing values of the sources so that condition for it must be fulfilled.

4. Recommendations

It is recommended that there must be implementation for both of conditions over more than two numbers of sources. In that condition, also there is equal sharing of the link in division basis on the number of sources. Further, also there can be implementation in MATLAB by changing the values of β and δ in the code. In such cases, there is observed different patterns for the same values of sources in both conditions. It can be visually observed in plot.

5. REFERENCES

1. C. Arun, K. Lakshmi Sudha, "Agricultural Management using Wireless Sensor Networks – A Survey", IPCBEE vol. 48 (2012)
2. F. Akyildiz and I. H. Kasimoglu, "Wireless Sensor and Actor Networks: Research Challenges," Ad Hoc Networks
3. JingXia Wang, JianDong Tang, Design and implementation of WSN monitoring system for grain depot based on XBee/XBee Pro, Electric Information and Control Engineering (ICEICE), 2011, International Conference Year:2011 , Pages: 4872 – 4874
4. Pankaj Govindrao Vispute, Dr. R. S. Kawitkar, "MATLAB Implementation of Wireless Sensor Network (WSN) in Precision Agriculture in Rural India", International Journal of Engineering Research

& Technology (IJERT) Vol. 1 Issue 4, June – 2012 ISSN: 2278-0181

5. Frida Gunnarsson, "Problems and Improvements of Internet Traffic Congestion Control", Reg nr: LiTH-ISY-EX-3098
6. B. Hull, K. Jamieson and H. Balakrishnan, "Mitigating congestion in wireless sensor networks," in proc. 2nd int. conference on embedded network sensor system.
7. R. Srikant, "The Mathematics of Internet Congestion Control", Birkhauser, 2004.
8. Dah-Ming CHIU and Raj JAIN, "Analysis of the Increase and Decrease Algorithms for Congestion Avoidance in Computer Networks

AUTHOR DETAILS:

	**Abhishek Singh,** B. Tech (Electronics & Communication Engineering), M. Tech (Digital & Wireless Communication Engineering) – Suresh Gyan Vihar University, Jaipur (Rajasthan), India. **E-mail:** abhisheksomvanshi17@gmail.com
	**Mr. Rashid Hussain,** M. Tech, MBA, PhD pursuing on "Application of WSN in Rural Development. Research area is WSN application from rural & urban areas. Member of Institute of Engineers, Members of extended Board of management. – **E-Mail:** hussain1992@gmail.com