ENHANCED WIRELESS NETWORK PERFORMANCE USING FUZZY LOGIC

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by

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ABSTRACT

Wireless networks which were once a rarity has now become commonplace especially in situations where traditional wired networks were deemed unsuitable. However, these networks are known to suffer problems of poor connectivity which results in low performance and high packet losses. Many problems in a wireless network could be attributed to congestion of the medium and the mobility of the mobile nodes because this results in false reports of link availability and therefore increases TCP retransmission timeouts.

In this thesis, an effort has been made to introduce fuzzy logic control into the MAC layer of an IEEE 802.11b wireless network model to diagnose the link between nodes based on the distances and relative velocities between communicating nodes. The proposed logic control predicts whether the nodes are still (and will remain) in communicating range and consequently attempt to reestablish a link between nodes and alleviate the false availability problem. Implementation of the proposal was developed and completed using the ‘ns’ network simulator. Results of simulation tests show that the fuzzy logic control increases the amount of packets transferred around 7% whilst maintaining the level of overhead traffic. The number of packets dropped during delivery is also reduced by around 4%, thus giving a higher delivery ratio of packets.
ACKNOWLEDGEMENTS

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<th>Description</th>
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<tbody>
<tr>
<td>ACK</td>
<td>Acknowledge/ment(s)</td>
</tr>
<tr>
<td>AI</td>
<td>Artificial intelligence</td>
</tr>
<tr>
<td>AODV</td>
<td>Ad hoc on-demand distance vector routing protocol</td>
</tr>
<tr>
<td>AP</td>
<td>Access point</td>
</tr>
<tr>
<td>API</td>
<td>Application programming interface</td>
</tr>
<tr>
<td>ARIB</td>
<td>Association of radio industries and businesses</td>
</tr>
<tr>
<td>ARP</td>
<td>Address resolution protocol</td>
</tr>
<tr>
<td>ATM</td>
<td>Asynchronous transfer mode</td>
</tr>
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<td>B-SIG</td>
<td>Bluetooth Special Interest Group</td>
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<tr>
<td>BSS</td>
<td>Basic service set</td>
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<tr>
<td>CBR</td>
<td>Constant bit rate</td>
</tr>
<tr>
<td>CCK</td>
<td>Complementary code keying</td>
</tr>
<tr>
<td>CLR</td>
<td>Clear</td>
</tr>
<tr>
<td>CONSER</td>
<td>Collaborative Simulation for Education and Research</td>
</tr>
<tr>
<td>CRC</td>
<td>Cyclic redundancy check</td>
</tr>
<tr>
<td>CSMA/CA</td>
<td>Carrier sense multiple access with collision avoidance</td>
</tr>
<tr>
<td>CSMA/CD</td>
<td>Carrier sense multiple access with collision detection</td>
</tr>
<tr>
<td>CTS</td>
<td>Clear to send</td>
</tr>
<tr>
<td>CW</td>
<td>Contention window / Congestion window</td>
</tr>
<tr>
<td>DARPA</td>
<td>Defense Advanced Research Projects Agency</td>
</tr>
<tr>
<td>DCF</td>
<td>Distributed coordination function</td>
</tr>
<tr>
<td>DGPT</td>
<td>Direction Generale des Postes et Telecominications</td>
</tr>
<tr>
<td>DIFS</td>
<td>Distributed inter frame space</td>
</tr>
<tr>
<td>DS</td>
<td>Distribution system</td>
</tr>
<tr>
<td>DSDV</td>
<td>Dynamic destination sequenced distance vector routing protocol</td>
</tr>
<tr>
<td>DSR</td>
<td>Dynamic source routing protocol</td>
</tr>
<tr>
<td>DSSS</td>
<td>Direct sequence spread spectrum</td>
</tr>
<tr>
<td>ECN</td>
<td>Explicit congestion notification</td>
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</table>
EIFS  Extended inter frame space
ESS   Extended service set
ETSI  European Telecommunications Standards Institute
FCC   Federal Communications Commission
FHSS  Frequency hopping spread spectrum
FTP   File transfer protocol
GHz   Gigahertz
GPRS  General packet radio service
HFC   Hybrid fibre coaxial
IBSS  Independent basic service set
IC    Industrie Canada
ICMP  Internet control message protocol
IEEE  Institute of Electrical and Electronics Engineers
IFQ   Interface queue
IP    Internet protocol
IR    Infrared
ISM   Industrial, scientific and medical
LAN   Local area network
LLC   Logical link control (layer)
MAC   Medium access control (layer)
Mbps  Megabits per second
MHz   Megahertz
MSDU  MAC service data unit
NAV   Network allocation vector
NIST  National Institute of Standards and Technology
NSF   National Science Foundation
OEM   Original equipment manufacturer
OFDM  Orthogonal frequency division multiplexing
OSI   Open system interconnection
OTcl  Object tool command language
PARSEC Parallel simulation environment for complex systems
PCF   Point coordination function
PDU   Protocol data unit
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>PHY</td>
<td>Physical (layer)</td>
</tr>
<tr>
<td>PIFS</td>
<td>Point coordination inter frame space</td>
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<td>PLCP</td>
<td>Physical layer convergence procedure</td>
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<td>PMD</td>
<td>Physical media dependant</td>
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<tr>
<td>QRY</td>
<td>Query</td>
</tr>
<tr>
<td>RF</td>
<td>Radio frequency(ies)</td>
</tr>
<tr>
<td>RREQ</td>
<td>Route request</td>
</tr>
<tr>
<td>RTO</td>
<td>Retransmission timer timeout</td>
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<tr>
<td>RTS</td>
<td>Request to send</td>
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<tr>
<td>RTX</td>
<td>Retransmission timer</td>
</tr>
<tr>
<td>SAMAN</td>
<td>Simulation augmented by measurement and analysis for networks</td>
</tr>
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<td>SIFS</td>
<td>Short inter frame space</td>
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<tr>
<td>SNR</td>
<td>Signal-to-noise ratio</td>
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<tr>
<td>SSID</td>
<td>Service set identifier</td>
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<td>SST</td>
<td>Slow start threshold</td>
</tr>
<tr>
<td>STA</td>
<td>Station</td>
</tr>
<tr>
<td>Tcl (TCL)</td>
<td>Tool command language</td>
</tr>
<tr>
<td>TCP</td>
<td>Transmission control protocol</td>
</tr>
<tr>
<td>Tk</td>
<td>Toolkit</td>
</tr>
<tr>
<td>TORA</td>
<td>Temporally ordered routing algorithm</td>
</tr>
<tr>
<td>UNII</td>
<td>Unlicensed national information infrastructure</td>
</tr>
<tr>
<td>UPD</td>
<td>Update</td>
</tr>
<tr>
<td>VBR</td>
<td>Variable bit-rate</td>
</tr>
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<td>VCS</td>
<td>Virtual carrier sense</td>
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<td>VLAN</td>
<td>Virtual local area network</td>
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<td>VoIP</td>
<td>Voice over IP</td>
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<td>WEP</td>
<td>Wireless equivalent protection / Wired equivalent privacy</td>
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<td>WLAN</td>
<td>Wireless local area network</td>
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<tr>
<td>WPA</td>
<td>Wireless privacy authentication / Wifi protected access</td>
</tr>
<tr>
<td>WPAN</td>
<td>Wireless personal area network</td>
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<tr>
<td>ZRP</td>
<td>Zone routing protocol</td>
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