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Microcontroller based Chat server using XBEE Module

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Abstract: Current electronics progression has led to many products that have the need to communicate between a series of microcontrollers, whether they be do-it-yourself projects or a commercial product. There are many multiple methods of talking from controller to controller, the popular ones being SPI, I2C, and UART/USART. Out of the mentioned options, UART and USART have gained popularity due to their simplicity; they require no addressing (though it can be used), only two wires to function. A USART is essentially a piece of computer hardware, usually used in conjunction with popular communication standards (such as RS-232), that translates data between parallel and serial forms over a computer or peripheral device serial port.

Keywords: VANETS, MANETs, Ad- hoc Network, NS-2.34, Trace graph

1. INTRODUCTION

Much can be learned about USART simply by understanding the acronym – Universal Synchronous/Asynchronous Receiver/Transmitter. Firstly, it can be noted that universal indicates its ability to be used generally by possessing the ability to configure data format and transmission speeds.

Synchronous and Asynchronous refer to methods of transfer. Asynchronous transmission keeps proper message format by framing the message with start and stop characters, thus ensuring the receiver knows how to interpret the message. Synchronous transfer is more efficient by keeping track of clock cycles, thus telling the receiver what it is supposed to read. The latter does not require a start and stop character, however, it does require "pad" characters to be sent when there is nothing to transmit in order to keep clocks synchronized.

Receiver and transmitter simply refer to the fact that the devices can receive and/or transmit. There are multiple classifications of this. Simplex refers to data transfer in one direction only, where the receiver device does not send data back to the transmitting device. Full duplex refers to simultaneous data transfer between devices. Finally, half duplex refers to devices that both send and receive, but take turns in doing so.

Structure of USART

A USART usually contains the following components:

- Clock generator
- Input and output shift registers
- Transmit/receive control
- Read/write control logic
- Transmit/receive buffers (optional)
- Parallel data bus buffer (optional)
- First-in, first-out buffer memory (optional)

Communication With USART

- Setting up communication between two microcontrollers using USART is done in four steps: Correct wiring of the microcontrollers
- Setup transmit and receive modes of operation
- Set baud rate
- Enable Interrupts if necessary

2. PROBLEM STATEMENT

It is sometimes not possible for vehicles to establish direct link between one another with the help of single hop, which is related with the specified area of coverage because of the varying velocities of vehicles and abrupt moves of paths without any notification, This proposal is highlighting the importance of routing protocols in VANET environments under different conditions and to observe and analyze their effects accordingly by mean of rigorous simulation test cases and comparative analyses.

3. WIRELESS AD-HOC NETWORK

Wireless Ad-hoc Network: A wireless ad-hoc network is a decentralized type of wireless network. The network is ad hoc because it does not rely on a pre-existing framework, such as routers in wired networks or access points in managed (infrastructure) wireless networks. Instead, each node engages in routing by forwarding data for other nodes, and so the assurance of which nodes forward data is made dynamically based on the network connectedness. In addition to the classic routing, ad hoc networks can handle flooding for forwarding the data.

An ad hoc network typically refers to any set of networks where all devices have equal status on a network and are free to associate with any other ad hoc network devices in link area. Very often, ad hoc network refers to a mode of application of IEEE 802.11 wireless networks.

VANET: A Vehicular Ad-Hoc Network or VANET is a technology that uses moving cars as nodes in a network to create a mobile network. VANET turns all participating car into a wireless router or node. VANET offers certain benefits to organizations of any size. While such a network does pose certain security concerns (for example, one cannot security type an email while driving), this does not limit VANET's as a productivity tool. GPS and navigation systems can benefits, as they can be integrated with traffic reports to provide the fastest route to work. A computer can move a traffic jam into a productive work time by having his email downloaded and read to him by the on-board computer, or if traffic decelerates to a halt, read it himself. It would also grant for free, VoIP services such as Google Talk or Skype between employees, lowering telecommunications damage. Future applications could involve cruise control making automatic adjustments to maintain safe distances between vehicles or alerting the driver of emergency vehicles in the area. To backing message differentiation in VANET, IEEE 802.11e standard is integrated in vehicular communication [4].

VANET Routing Protocols: All of the standard wireless protocol companies are examining with VANET. This includes all the IEEE protocols, Bluetooth, Integrated Resource Analyses (IRA) and Wi-Fi. There also are VANET analyze using cellular and satellite technologies. Dedicated Short Range Communications (DSRC) is a protocol that has been specifically for use with VANET. DSRC has several advantages: it earlier operating at 5.9 GHz, it is uncomplicated to individualize and it is oriented to the idea of transmitting along a street grid framework--as opposed to the Omni directional transmission, which is usual for most wireless protocols [5].

AODV: AODV is the on-demand (reactive) topology-based routing protocol 9 in which backward learning procedure is utilized in order to record the previous hop (previous sender) in the routing table. In the backward learning procedure, upon receipt of a broadcast query (RREQ)10 which contains source and destination address, sequence numbers of source and destination address11, request ID and message lifespan, the address of the node sending the query will be recorded in the routing table. Recording the stipulation of previous sender node into the table enables the destination to send the reply packet (RREP) to the source through the path obtained from backward learning. A full duplex path is established by flooding query and sending of reply packets. As long as the source uses the path, it will be maintained. Source may trigger to establish another query-response procedure in order to find a new path upon receiving a link failure report (RERR) message which is forwarded recursively to the source12. Being on-demand to establish a new route from source to destination enables AODV protocol to be utilized in both unicast and multicast routing13. The propagation of RREQ packet and path of RREP reply packet to the source. Multiple RREP messages may be delivered to the source via different routes but updating the routing entries less than one condition which is if the RREP has the greater sequence number. A message with higher sequence number represents the more accurate and fresh information. Several enhanced approaches were proposed to eliminate the large overhead and high latency (End-to-End Delay) which result in encountering high amount of packet loss occur in AODV routing protocol.

AOMDV: AOMDV is designed to calculate multiple paths during the route discovery in highly dynamic ad hoc networks where the link breakage occurs frequently due to high velocity of vehicles. In AODV routing protocol, a route discovery procedure is needed after each link failure. Performing such procedure results in high overhead and latency. Thus, this defect is overcome by having multiple paths available. In AOMDV, route discovery procedure will be done after all paths to either source or destination fail. In AOMDV routing protocol, it is endeavored to utilize the routing information already available in the underlying AODV protocol. However, little additional modification is required in order to calculate the multiple paths. The AOMDV protocol includes two main sup-procedures.

Destination Sequenced Distance Vector (DSDV): The aforementioned discussed routing protocols are all reactive protocols in which the routes are established on demands. DSDV 23 is a proactive routing protocol which maintains the route to the destination before it is required to be established. Therefore, each node maintains a routing table including next hop, cost metric towards the destination node and the sequence number generated by the destination node. Nodes exchange their routing tables periodically or when it is required to be exchanged. Thus each node is able to utilize the updated list of nodes to communicate with. Due to being aware of the neighbor`s routing table, the shortest path towards the destination could be determined. However, the DSDV mechanism incurs large volume of control traffic in highly dynamic networks such as VANET which results in experiencing a considerable amount of bandwidth consumed. In order to overcome the mentioned shortcoming, two update strategy in proposed; i. full dump strategy which is infrequently broadcasting the whole routing table, and ii. Incremental dump which is exchanging the minor changes since the last full dump exchange.

4. SIMULATION AND RESULT

Simulation Parameters: In our scenario we take 40 nodes .and various speed of 20, 40 and 60m/sec. The simulation is done using an open source simulator NS-2, to analyze the performance of the network by varying the nodes mobility. The protocols parameters used to assess the performance are given below:

PDR: In order to calculate the Packet Delivery Ratio (PDR) in velocity and density scenarios, the number of packets received by the destination will be divided by the number of packets originated. The attained value specifies the packet loss rate which confines the maximum throughput of the network. The better PDR implies the more accurate and suitable routing protocol.

Throughput: Throughput is the average rate of successful message delivery over a communication channel. The system throughput or aggregate throughput is the sum of the data rates that are delivered to all terminals in a network. Throughput is essentially synonymous to digital bandwidth consumption; it can be analyzed mathematically by means of queuing theory,

Average End-to-End Delay: The time taken by the data packets to be delivered from source to destination is known as Average End-to-End Delay. Therefore, the time at which the first data packet is received by destination deducted from the time at which the first packet transmitted by the source. The Average End-to-End delay value implies the time consumed for all possible delays caused by buffering procedure whilst performing route discovery procedure, interface queuing, the retransmission procedure performed at MAC and propagation times. Figure 6 illustrates the Average End-to-End delay diagram associated with mentioned routing protocols.

Normalized Routing Load: Normalized routing load (NRL) is defined as the number of routing packets transmitted per data packet arrived at the destination.

Simulation Parameter:

Table 1: Simulation Parameters Considered

Parameters	Values
Simulator	NS-2.35
Mobility Model	Random Way Point
Antenna type	Omini
Area of Map	1000*1000
PHY/MAC	IEEE 802.11p
Routing Protocol	AODV,DSDV,MAODV
Network Traffic	TCP,UDP
Simulation Time	100sec
Antenna type	Omini
Speed	20,40,60 m/sec

Simulation Results for 20 m/sec:

20m/sec	AODV	DSDV	MAODV
ENERGY (JOULE)	50.21463	39.80059	72.15637
E2E DELAY (MS)	210.192	200.193	319.364
PDR(%)	r/s=0.9634	r/s=0.9579	r/s=0.9891
TPUT (KBPS)	728.49	492.2	1013.3

Simulation Results for 40 m/sec:

40m/sec	AODV	DSDV	MAODV
ENERGY (JOULE)	64.90293	53.96993	86.29875
E2E DELAY (MS)	214.604	279.405	422.105
PDR(%)	r/s=0.9668	r/s=0.9508	r/s=0.9860
TPUT (KBPS)	641.82	467.07	879.59

Simulation Results for 60 m/sec:

60m/sec	AODV	DSDV	MAODV
ENERGY (JOULE)	91.33486	61.7386	31.83515
E2E DELAY (MS)	228.205	305.894	335.145
PDR(%)	r/s=0.9741	r/s=0.9447	r/s=0.9936
TPUT (KBPS)	718.06	453.34	914.54

Analysis for VANET Scenario: VANET when implemented with different mobility scenario on following parameters:

Energy Consumption: Energy consumption in MAODV protocol in all the cases except 60m/sec is less as compare to AODV and DSDV

E2E Delay: When we look across end to end delay than MAODV having more delay with all the node speed as compared with AODV and DSDV.

PDR: PDR for all the cases for MAODV under VANET environment is better as compared with AODV and DSDV.

Throughput: Throughput of MAODV routing protocol is better for each mobility model for VANET.

5. CONCLUSION

Testing the hardware are satisfactory and the According to this project we can implement a data communication system in which ZIGBEE technology is used by which one can communicate with more than one, wirelessly The results obtained on design is ready to be scaled for a full fledged Wireless Sensor Network. The objective of power reduction inthe nodes has been realized. With the use of more sophisticated fabrication of the hardware this design is ideal to be used for implementation of various commercial and industrial application.

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