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Ensuring Reliable Data Delivery in MANET through Ant Colony Optimization

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Abstract: ***MANETs is generally represented as an application of Wireless Ad-hoc Network which allows communication and transaction of information through mobile nodes during movement of nodes randomly without any centralized control. The issue faced in MANET is efficiency and reliability in data transaction therefore a cross layer and reliable opportunistic routing algorithm (CBRT) for MANETs has been proposed. However the working of CBRT achieves better performance in data transaction, the issues faced is path selection between sources to destination. It focuses on reliable transaction and it does not includes distance between source to destination hence delay in information transaction has been occurred. In our proposed in addition to CBRT focusing on distance parameter, Ant Colony Optimization (ACO) has been deployed. In this each node in ACO will contain Forward and Backward Ant (FANTs and BANTs) respectively. These parameters will collect the neighboring node details such as energy and distance between nodes to destination. Hence shortest path between source to destination is selected similarly packets are delivered without any loss.***
Keywords: MANETs, CBRT, Ant Colony Optimization, FANTs and BANTs and reliable data delivery.

I. INTRODUCTION

A. MANET

MANET is a self arranging system of versatile switches associated by remote connections with no passageway. Each cell phone in a system is self-ruling. The cell phones are allowed to move indiscriminately and compose themselves subjectively. Hubs in the MANET share the remote medium and the topology of the system changes sporadically and progressively. In MANET, breaking of correspondence interface is visit, as hubs are allowed to move to anyplace. The thickness of hubs and the quantity of hubs are relies upon the applications in which we are utilizing MANET. MANET have offered ascend to numerous applications like Tactical systems, Wireless Sensor System, Data Networks, Device Networks, and so on. With numerous applications there are still a few configuration issues and difficulties to survive. The fundamental objective of versatile impromptu systems administration is to broaden portability into the domain of self-sufficient, versatile, remote areas, where a lot of hubs which might be consolidated switches and has - they structure the system steering foundation in a promotion hoc style. Part of security vulnerabilities in a remote domain, for example, MANET, has been recognized and a lot of countermeasures were additionally proposed. Be that as it may, just a couple of them give a surety which is a symmetrical to security basic test. Bringing these variables into concern, the primary vision of portable specially appointed systems administration is to help hearty and proficient activity in portable remote systems by joining steering usefulness into versatile hubs. Such systems are imagined to have dynamic, some of the time quickly evolving, irregular, multihop topologies which are likely made out of generally data transmission compelled remote connections.

B. Attacks in MANET

Securing wireless ad-hoc networks is an exceptionally testing issue. Getting conceivable type of assaults is dependably the initial move towards growing great security arrangements. Security of correspondence in MANET is significant for secure transmission of data. Nonappearance of any focal co-appointment component and shared remote medium makes MANET increasingly powerless to advanced/digital assaults than wired system there are various assaults that influence MANET.

1) *Passive Attack:* in this sort of assault, the interloper just plays out some sort of observing on certain associations with get data about the traffic without infusing any phony data. This kind of assault serves the aggressor to pick up data and makes the impression of the attacked arrange so as to apply the assault effectively. The sorts of latent assaults are listening in, traffic investigation and snooping.

2) *Active Attack:* In this kind of assault, the interloper plays out a viable infringement on either the system assets or the information transmitted; this is finished by International Journal on New Computer Architectures and Their Applications causing steering disturbance, arrange asset exhaustion, and hub breaking.

Black hole Attack: Route discovery process in AODV is defenseless against the dark opening assault. The component, that is, any middle of the road hub may react to the RREQ message in the event that it has a sufficiently new course, formulated to diminish steering delay, is utilized by the malevolent hub to bargain the framework. In this assault, when a malignant hub tunes in to a course demand parcel in the system, it reacts with the case of having the most brief and the freshest course to the goal hub regardless of whether no such course exists. Accordingly, the malevolent hub effectively misroute arrange traffic to it and afterward drop the bundles short lived to it.

Wormhole Attack: In a wormhole assault, an assailant gets parcels at one point in the arrange, "burrows" them to another point in the system, and after that replays them into the system starting there. Steering can be disturbed while directing control message are burrowed. This passage between two conniving assaults is known as a wormhole .In DSR, AODV this assault could forestall revelation of any courses and may make a wormhole notwithstanding for parcel not deliver to itself on account of broadcasting. Wormholes are difficult to distinguish in light of the fact that the way that is utilized to pass on data is typically not part of the real system. Wormholes are hazardous on the grounds that they can do harm without knowing the system.

Gray-hole attack: This assault is otherwise called directing misconduct assault which prompts dropping of messages. Dark opening assault has two stages. In the main stage the hub publicize itself as having a substantial course to goal while in second stage, hubs drops captured parcels with a specific likelihood.

II. LITERATURE SURVEY

Sanjit Biswas and Robert Morris (2003), presents extremely Opportunistic Routing (ExOR), another unicast directing method for multi-jump remote systems. ExOR advances every parcel through a grouping of hubs, conceding the decision of every hub in the arrangement until after the past hub has transmitted the bundle on its radio. ExOR then figures out which hub, of every one of the hubs that effectively gotten that transmission, is the hub nearest to the goal. That nearest hub transmits the bundle. The outcome is that each bounce moves the parcel more remote (all things considered) than the jumps of the most ideal foreordained course. The ExOR configuration tends to the test of picking a sending hub after transmission utilizing a dispersed calculation. To begin with, when a hub transmits a parcel, it incorporates into the parcel a basic calendar portraying the need request in which the potential recipients ought to advance the parcel. The hub figures the timetable dependent on shared estimations of between hub conveyance rates. ExOR then uses a disseminated opened MAC convention for affirmations to guarantee that the beneficiaries concur who the most noteworthy need beneficiary was. The adequacy of ExOR depends predominantly on the rate at which the gathering likelihood tumbles off with separation.

Yuh-Shyan Chen and Chih-Shun Hsu (2009), describes the objective of the system versatility (NEMO) the board is to successfully diminish the intricacy of handoff strategy what's more, keep the cell phones associated with the Internet. Vehicle is moving so quick that it might cause the handoff and parcel misfortune issues. Both of the issues will drop down the throughput of the system. To beat these issues, we propose a novel NEMO convention for vehicular specially appointed system (VANET). In interstate, since each vehicle is moving a fixed way with high moving rate, the vehicle receiving our convention can procure IP address from the VANET through vehicle to vehicle interchanges. The vehicle can depend on the help of the front vehicle to execute the pre-handoff system or it might obtain its new IP address through multi-bounce transfers from the vehicle on the paths of the equivalent or inverse heading and therefore diminishes the handoff delay and keep up the availability to the Internet. Reenactment results have demonstrated that the proposed plan is capable to diminish both handoff postponement and bundle misfortune rate.

Antonio M. Ortiz et.al (2011), presents the undertaking of steering information from a source to the sink is a basic issue in specially appointed and remote sensor systems. In this paper, the utilization of fluffy rationale to perform job task amid course foundation and support is proposed. An steady methodology is given and looked at comparative existing steering conventions. Productive steering approaches give arrange load equalization to broaden organize lifetime, effectiveness upgrades, and information misfortune evasion. Investigations show promising outcomes for our recommendations and its reasonableness for working with thick systems, getting speedy course creation just as vitality productivity.

Angeline Reeba.V (2015**),** describes the idea of Vehicle Ad-Hoc organizes which has been made suitable by the combination of remote interchanges what's more, advanced gadgets in transportation models. A Vehicle Ad-hoc Networks (VANETs) comprises of Road side unit (RSU) and vehicular framework - a way to most extreme network. They give access to numerous frameworks and use transportations framework for correspondence. VANET's are experiencing fast changes due to the modernize utilization of

innovation in more secure, productive transportation and utilized for various applications. So as to give the definite examination and better comprehension about the specialized issues of VANETs, this paper shows a definite report on late advances and open research issues in VANETs. To begin with, the best in class of different directing conventions and calculations are investigated, an audit of components affecting the structure of VANETs is given and dissected to distinguish a superior answers for correspondences. At that point, the directing model for vehicular framework is laid out, and the calculations and conventions created for each layer in the writing are investigated. At last, wide research issues in the mechanical gauges and momentum application of the VANETs is examined, with a goal to start new research interests in this field.

Payal Jadhav and Prof. Rachna Satao (2016), discusses opportunistic routing is another worldview in directing for remote sensor organize which picks the hub nearest to the objective hub for sending the information. It utilizes the telecom idea of remote sensor systems. Pioneering directing has expanded the proficiency, throughput and dependability of sensor systems. Numerous vitality sparing systems has been presented utilizing pioneering directing in remote sensor systems for expanding the system lifetime. In this article we have expounded the essential idea of Sharp steering, diverse territories in which it has been professed to be gainful, a few conventions their measurements and their disadvantages.

Mr. Shankarling Umadi et.al (2014), describes mobile social networks (MSNs) are a sort of defer tolerant system that comprises of bunches of portable hubs with social qualities. As of late, numerous social aware calculations have been proposed to address directing issues in MSNs. Be that as it may, these calculations will in general forward messages to the hubs with locally ideal social qualities, and subsequently can't accomplish the ideal execution. In this paper, so proposed a conveyed ideal Community-Aware Opportunistic Routing (CAOR) calculation. Our principle commitments are that we propose a home-mindful network model, whereby we transform a MSN into a system that just incorporates community homes. We demonstrate that, in the system of network homes, despite everything we can process the base expected conveyance deferrals of hubs through a switch Dijkstra calculation and accomplish the ideal shrewd steering execution. Since the quantity of networks is far not exactly the quantity of hubs in greatness, the Computational expense and support cost of contact data are significantly diminished.

A. Problem Identification

1) Due to mobility in nature the nodes in MANETs will changes frequently, hence the packet transaction will get affected and it affects the packet delivery ratio.

2) Similarly due to its portability nature transmission power should be adjusted frequently, hence it will consumes more energy compared to evaluated energy level hence a system should be developed to balance this issues.

3) Delay in packet transmission between source and destination will occur in CBRT because it focuses on reliable data delivery and it does not concentrates on distance and energy consumption.

III. PROPOSED SYSTEM

In this section, considering the advantages of CBRTs reliable data delivery process the issues faced here is delay in packet delivery between sources to destination. In our proposed, ACO is deployed to calculate the neighboring nodes energy and distance to destination. From this minimum distance is selected and reliable in data transaction is obtained is discussed clearly in this section.

A. Cross-layer Optimization

There are many cross layer designs in the MANETs to improve network efficiency. Opportunistic routing should apply the cross-layer concept and fully utilize information in the physical layer and application layers. Application-aware adaptation of queue management at the lower layers can improve the user experience.

B. Ant Colony Optimization (ACO)

Communication between source and destination should be processed in efficient way through selecting optimal path. This optimal path selection is done through ACO. It works based on ant behavior. To feed the queen the workers ant left their nest and find food. Using its antenna it smells food. While search of food ant will spread a chemical substance called pheromone that evaporates within a particular time. Once the ant find the food it will return to its nest while travelling it will spread the pheromone in order to increase the intensity of the road. Along the pheromone and its intensity worker ants travels through the roads. Hence ant leaves the nest and searches the food by following the pheromone trail towards the food source.

The proposed model uses Ant Colony Optimization to predict the optimal route from the source node to the destination node depending on different parameters such as energy and velocity of nodes, number of nodes in the path and travel time from the

source to the destination node. This model uses four types of ant and contains five phases namely: Joining Network, Distance computing, Route Exploring, Evaporation rate, and Route Recovery.

C. Joining Network

In this phase, when a mobile nodes want to joins the system it communicates its neighbors Ant (NA) to all adjacent nodes. When node gets NA it will checks the table which contain source ID that exist in table, at that point it reset the record expiry time, else it makes another record for the new node with starting pheromone estimation of 0.0. Every mobile node communicates NA each particular times to educate different hubs about its reality close them. The communicate time is set by the clients dependent on the system condition.

D. Distance Computing

In this phase, each mobile node has a Distance Calculation Timer that is set by the users based on the network environment. Each node computes the distance from other nodes using the power presented in the received radio signal using Received signal strength indication (RSSI).

$$P_r(i,j)=\frac{Pt*Gt*Gr*H2t*H2r}{D4*L}$$

E. Route Exploring

In this phase, source node broadcasts Route_Finder_Ant (RFA) to all single hop adjacent nodes. The list of nodes that are visited by RFA is available in it. Hence neighboring node receives RFA, checks the received node is destination node or not. If it is not destination then it will considered to be intermediate nodes. The intermediate node unicasts RFA toward the next hope of the destination node using the high pheromone value indication. Otherwise, it rebroadcasts RFA to all single hop adjacent nodes, the rebroadcasting process continues until the destination node is reached. Once the destination receives RFA it will send the acknowledgement as a collecter Ant (CA) to the source node. From the list RFA to find the route CA uses the path available in it, where the CA travels through the nodes within the path.

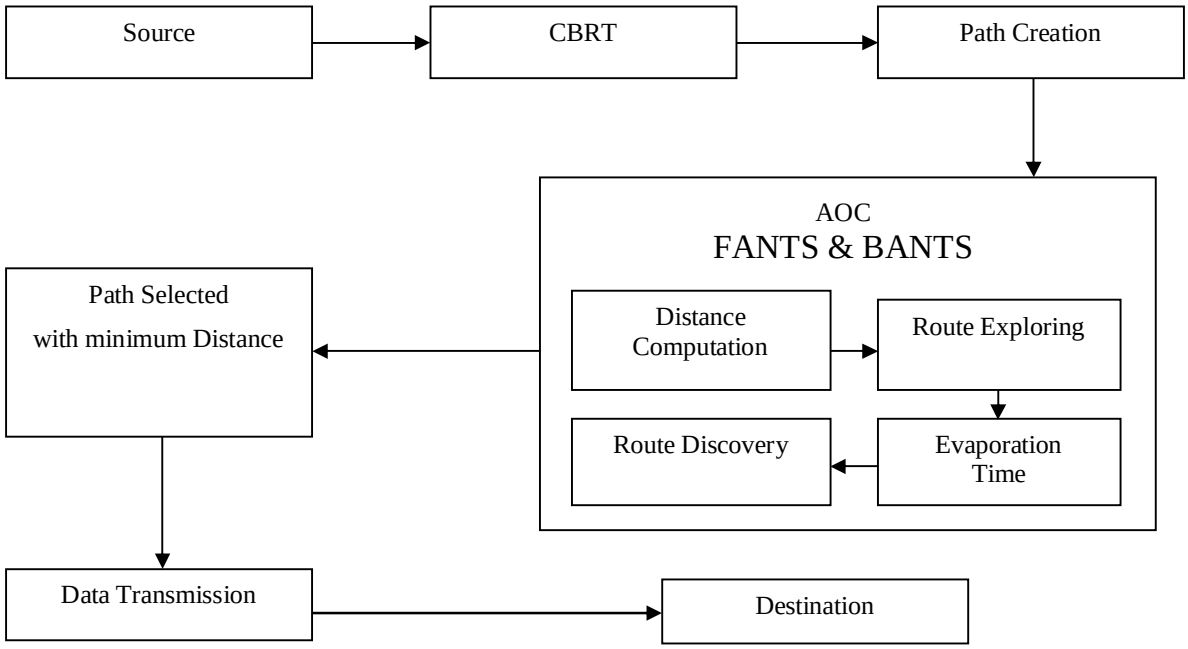

Figure 1: system architecture

F. Evaporation Rate

In this phase, each mobile node updates the pheromone value for each node in its table using the evaporation every specific period of time that is set by the users based on the network environment.

G. Route Recovery

In this phase, if a source node detects a link failure, it broadcasts an Error_Ant (EA) to all its neighbor nodes to stop using this node in transmitting and to reduce its link pheromone value to zero. If an intermediate node detects a link failure, it unicasts EA to the source node to stop transmitting and starts the Route Exploring phase again.

H. Implementation Process

1) *Implementation of MANET and Opportunistic Routing:* IN this module, a mobile ad hoc network is created with multiple mobile nodes. Each mobile node can move around the network. An opportunistic routing is implemented between the mobile nodes. The source node chooses the candidate relay set (CRS) and decides the priorities of the relay nodes based on specific metrics, such as the distance to the destination node, the expected transmission count (ETX), the propagation delay, the packet queue length .
2) *Implementation of CBRT Scheme:* In this module, the proposed CBRT scheme is implemented in the network. In CBRT, each node acquires the locations of other nodes in the network through periodic probe packet exchanging. Only the locations of other nodes are maintained periodically by each node. Once the source node wants to send data packet to the destination node, first, it will broadcast the RREQ (Route Request) to its neighbors. The neighbors are the nodes who have one-hop bi-directional communication links with the source node.
3) *Data Communication Using CBRT:* The RREQ includes the node IDs of the source node and the destination node. The neighbors who receive this message will calculate the distances to the destination node. The neighbor nodes whose distances to the destination node are larger than the distance between the source node and destination node will drop the RREQ packet directly. Only the neighbor nodes whose distances to the destination node are smaller than the source node will reply RREP (Route Request Response) message to the source node.
4) *Implementation of ACO Method in MANET:* In this module, an ant colony optimization algorithm is implemented in the network. To reduce the computational complexity in the proposed algorithm, we enhance the current method by including the one of the familiar swarm intelligence technique ACO to collect the real time details in the link to make the CRS more optimistic and better way.

IV. RESULT AND DISCUSSION

In this section the result obtained with respect to our proposed system has been shown in graph and discussed. The performance of our system has been identified by the parameters like throughput, end to end delay and energy consumption.

A. Throughput

Figure 2 shows that our proposed system achieves high throughput compared to existing systems. The graph obtained based on number of packets transmitted with respect to time.

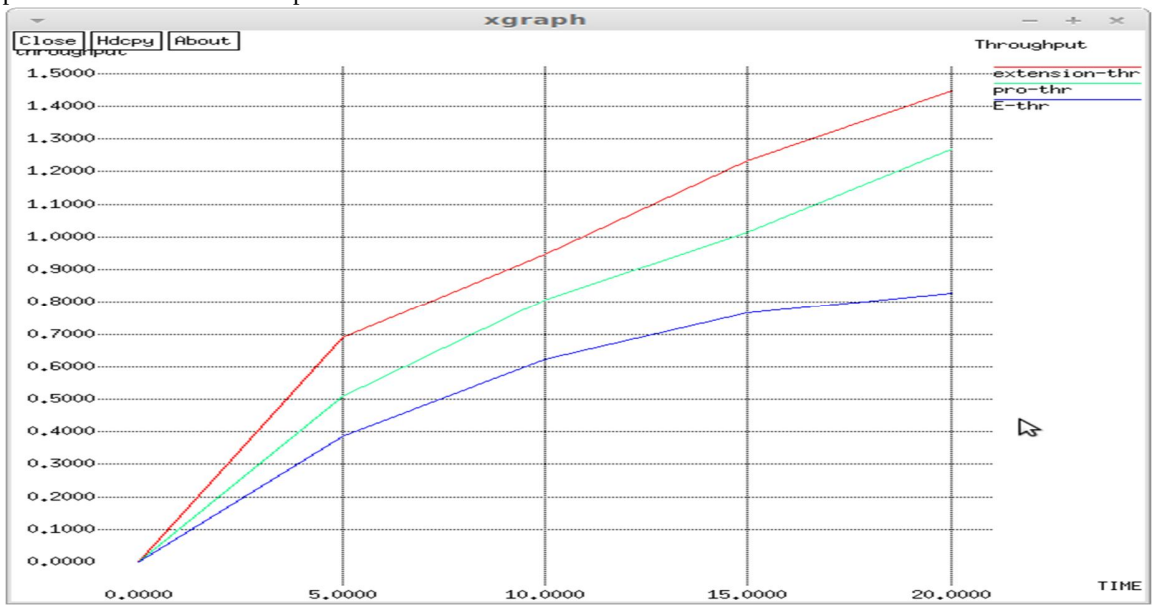

Figure 2: Throughput comparison of proposed and existing system

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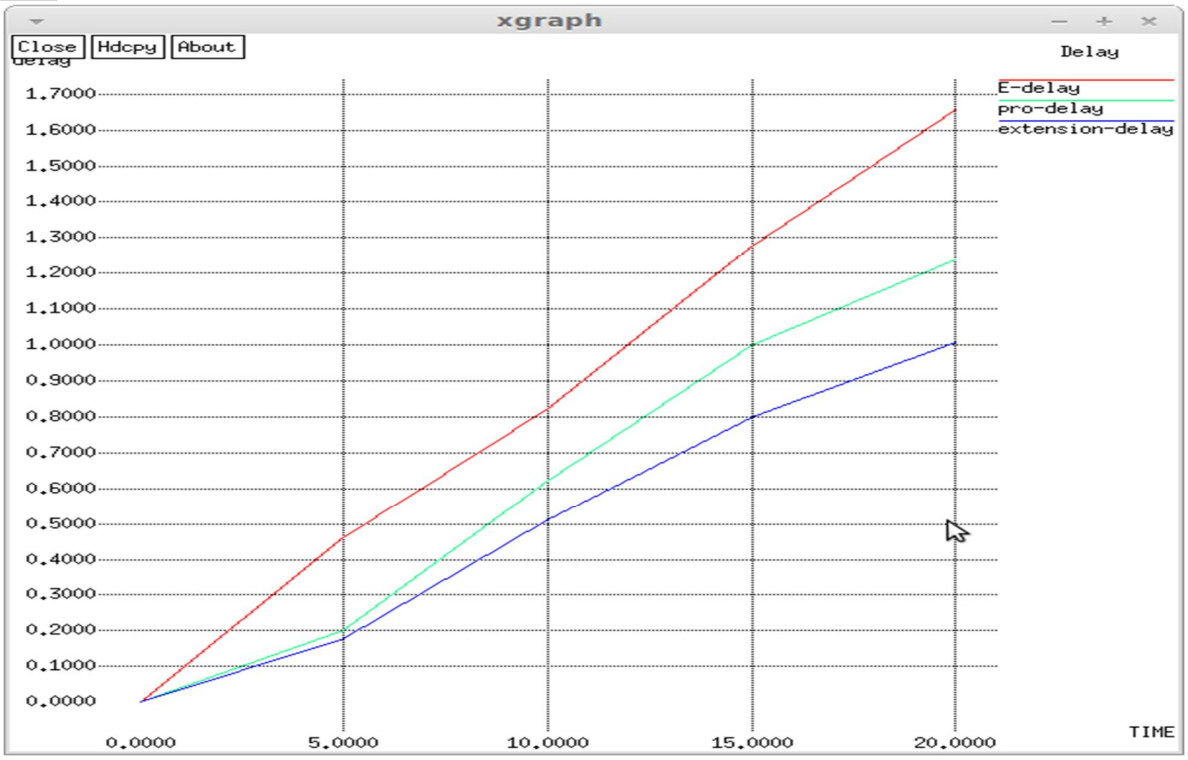

Figure 3: Delay of packet delivery comparison

The objective of our system is to achieve minimum delay in packet delivery between sources to destination. By implementing CBRT, reliable data delivery is achieved to obtain minimum delay in data transaction ACO is added in our proposed. Therefore the FANTs and BANTs would collect neighboring nodes information and create path according to that.

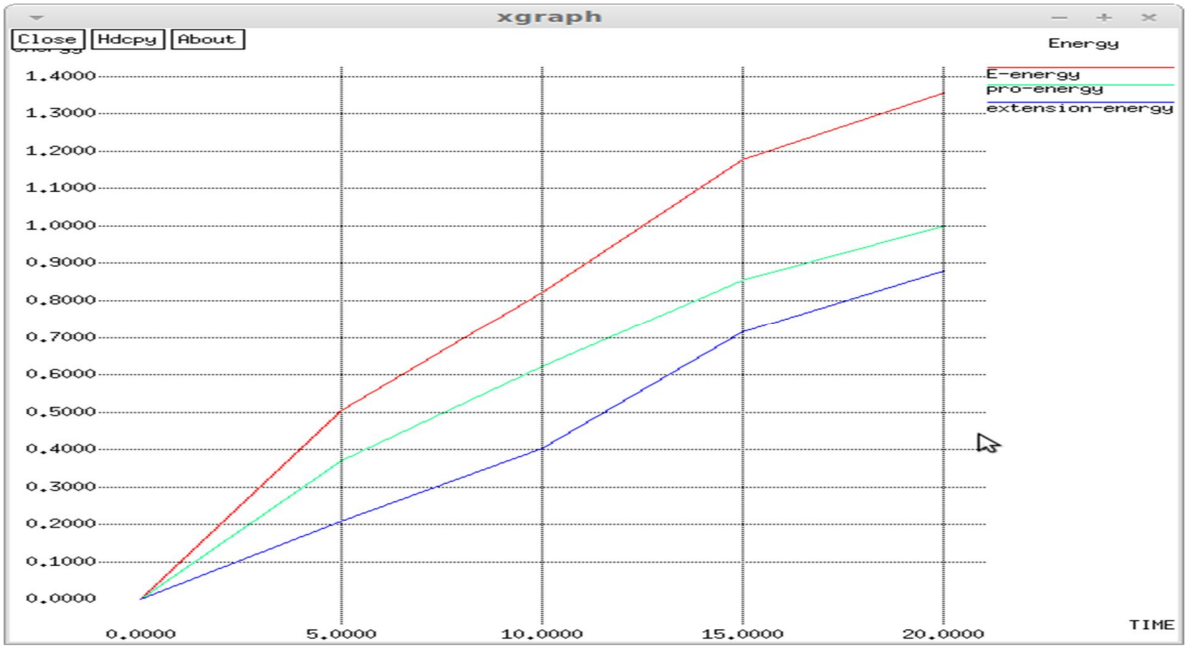

Figure 4: Comparison of energy consumption of our proposed and existing system

The above figure shows that our proposed system achieves minimum energy consumption compared to existing systems. This parameter is achieved by selecting shortest distance between source to destination through CBRT and ACO.

V. CONCLUSION

MANETs is an independent and ad hoc network which creates path and transfer data between sources to destination. The portability nature is an major advantage similarly it leads to performance drawback also. Hence CBRT is an opportunistic routing algorithm utilized for reliable and efficient data transaction in the network. The issue faced here is long paths are selected for data transaction concentrating on reliability parameter alone. Maximum number of long paths was selected for transaction. By utilizing its reliability factor minimum distance is calculated through ACO. The FANTs and BANTs in ACO will calculate neighboring nodes information such as energy, packet time and distance it selects shortest path with appropriate energy levels of nodes. Hence it concludes that our proposed system achieves reliable and efficient data transaction between sources to destination and achieves better performance compared to existing approaches.

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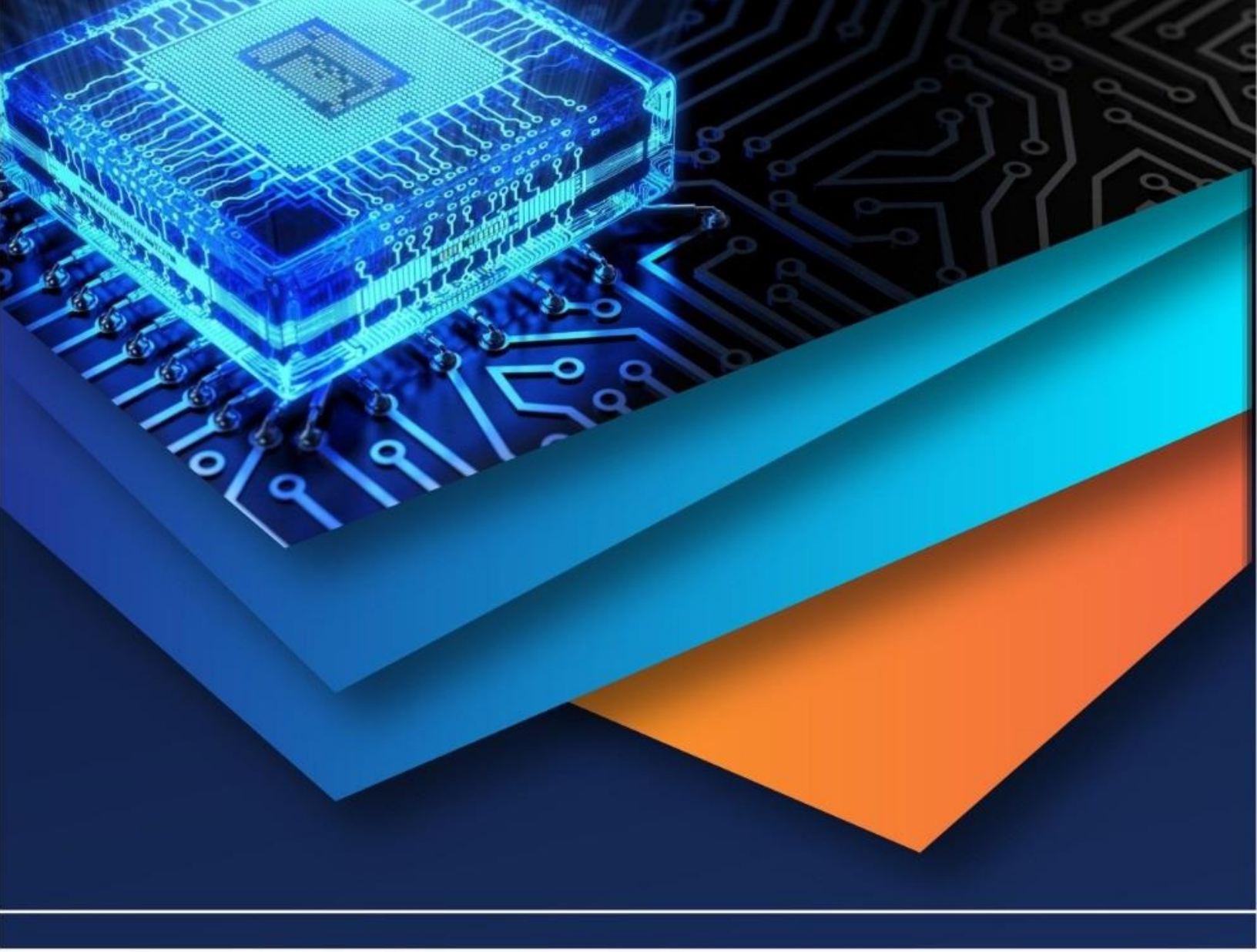

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