Minimization of time Delay Using Ring Structure in IOT

Project report submitted in partial fulfillment of the requirement for the degree of Bachelor of Technology

in

Computer Science and Engineering/Information Technology

By

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to

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Candidate's Declaration

I hereby declare that the work presented in this report entitled **Minimization of time Delay Using Ring Structure in IOT** in partial fulfillment of the requirements for the award of the degree of **Bachelor of Technology** in **Computer Science and Engineering/Information Technology** submitted in the department of Computer Science & Engineering and Information Technology**,** Jaypee University of Information Technology Waknaghat is an authentic record of my own work carried out over a period from August 2019 to May 2020 under the supervision of **Mr. Arvind Kumar** Asst. Professor Computer Science & Engineering.

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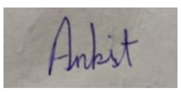
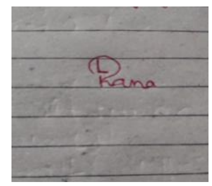
The matter embodied in the report has not been submitted for the award of any other degree or diploma.



(Student Signature)
Ankit Srivastava
161284



Laxit Rana
161278

This is to certify that the above statement made by the candidate is true to the best of my knowledge.

(Supervisor Signature)
Mr. Arvind Kumar
Asst. Professor
Computer Science & Engineering
Dated: 30/07/2020

ACKNOWLEDGEMENT

We would like to express our special thanks of gratitude to our Project Supervisor Mr. Arvind Kumar who gave us the golden opportunity to do this wonderful project on the topic **Minimization of time Delay Using Ring Structure in IOT**, *which also helped us in doing a lot of Research and we came to know about so many new things we are really thankful to them. Secondly we would also like to thank our parents and friends who helped us a lot in finalizing this project within the limited time frame.*

(Ankit Srivastava)
(Laxit Rana)

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LIST OF ABBREVIATIONS

IEEE	Institute of Electrical and Electronics Engineers
IoT	Internet of Things
WSN	Wireless Sensor Network
CH	Cluster Head
CM	Cluster Member
DADCNS	Delay-Aware Data Collection Network Structure
CTP	Collection Tree Protocol
SC	Single Chain
ETX	Expected Transmissions
MST	Minimum Spanning Tree
SCH	Sub Cluster Head
IVP	Invitation Packet
RP	Rejecting Packet
CR	Connection Request
MAC	Media Access Control
CDMA	Code Division Multiple Access
DCT	Data Collection Time
MANET	Mobile Adhoc Network
N2N	Node to Node
N2BS	Node to Base Station
N2N	Node to Node
MCU	Microcontroller Unit
TCR	Transceiver Unit

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PROJECT OBJECTIVES

1.1 Introduction

What is IoT?

The Internet of Things (IoT) is the system of numerous electronic and/or electrical gadgets, for example, physical gadgets, vehicles, gadgets, and different components that coordinate with hardware, programming, sensors, actuators, and network between these gadgets We can share these as a framework. This association offers the likelihood to interface, gather and trade information. This makes open doors for a more straightforward mix of the physical world into digital frameworks, which adds to expanding effectiveness, accomplishing financial advantages, and along these lines to a general decrease in general human exertion

The quantity of IoT gadgets expanded by 31% year-on-year to EUR 8.4 billion. It is assessed that 30 billion gadgets will be associated with such frameworks by 2020.

IoT not just includes associating gadgets generally associated with the Internet or different systems, for example, cell phones, tablets, PCs, PCs, and so forth., yet in addition interfacing gadgets that are customarily viewed as imbecilic gadgets, for example, coolers, siphons, and water and so on lights, fans, and other comparable gadgets, and when you consider it, the association between these gadgets opens up numerous new ways to the administrations that the IoT can give to diminish individuals' infringement, increment by and large solace and give surprising administrations. a couple of years back

Thoughts like control lights, enthusiasts, fountains, and so forth., have turned into a reality that was beforehand part of sci-fi, or just conceivable with innovations that were past the scope of the majority, yet now they are available and moderate.

For wireless networks that offer time-touchy data on the fly, it's insufficient to transmit information rapidly. That information additionally should be new. Think about the numerous sensors in your vehicle. While it might take not exactly a second for most sensors to transmit an information bundle to a focal processor, the age of that information may change, contingent upon how much of the time a sensor is transferring readings.

In a perfect network, these sensors ought to have the option to transmit refreshes continually, giving the freshest, most current status for each quantifiable component, from tire strain to the nearness of obstructions. In any case, there's just so much information that a wireless channel can transmit without totally overpowering the network.

How, at that point, can a continually refreshing network — of sensors, automatons, or information sharing vehicles — limit the age of the data that it gets at any second, while simultaneously keeping away from information blockage?

ABSTRACT

IoT system have a massive amount of smart devices which leads to maximization of massive amount of data. So to improve the performance of the IoT system our main task is to minimize the time delay. In Normal wireless network delay is defined as the time taken for the amount of data to transfer from sender end to the receiver end. So in this a delay minimization technique is described for the wireless sensor network . In data collection tree the time taken to send data to destination is efficient but the uses the number of β-rings in less number of times which we can improve by generating another algorithm which uses the basics of the concurrent data gathering tree with the advancement of maximizing the α-ring and β-ring as well. As β-ring take less time to transfer the data so the maximization of β-ring will lead to minimization of delay.

LITERATURE

In IoT arrange a great deal of gadgets cooperate. They create huge measures of information. Consequently, information gathering process turns into a central worry in extensive systems. Information gathering forms must use least measure of time while gathering information. In this paper a ring type network structure is used where the nodes are arranged in the form such that data is collected by the nodes and then send to the base station. A ring network topology is further represented in the form of a tree where root is the base station and other nodes are the part of the tree. The ring structure is divided in to two parts α-Ring and β-ring. In this paper they use the number of alpha rings more and it causes increase in delay. To solve this problem, we are trying to design an approach which is proposed as an algorithm in this project.

Data Collection tree:

It is the tree structure used to collect data from various places. It consists of node and base station. Each node can communicate with the another node at any time and the time taken to communicate is to be considered zero for the calculation of delay.

Let us consider a network structure N which have n number of nodes and A base station B which are of b number of time.

$N = \{n_1, n_2, n_3, \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \; n_N \text{ times}\}$

$B = \{b_1, b_2, b_3, \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots b_s \text{ times}\}$

In this structure the data is collected using ring topology where the nodes are collected in the shape of ring and each node is going to collect the data and send that

data to the base station. the Data is collected in the form of streams and these streams were fuse using the nodes and after fusing data it is sent in to base station. Each data is fused before forwarding that data in to its parent.

Let us suppose that single part of stream takes one-unit time-slot and the time taken to fuse the data is negligible. The data is aggregated using base station and each stream has its own base station for the aggregation of data.

Assume there are s data streams. These data streams are arranged in such manner so every stream begins at same time allotment and ends at same time allotment. As data is gathered equal so the number of nodes utilized by every datum stream is same and most extreme so that there is no inconsistency in collection of data just as less time delay in data collection. To choose the greatest number of nodes if Total number of nodes present are |N| and the streams are s than the most extreme nodes use by every datum stream is

$$m_{max} = \left\lfloor \left(\frac{|N|}{s} \right) \right\rfloor$$

where in floor(x) (⌊ x ⌋) is the characteristic that takes as enter an actual quantity x and gives an output which returns the integer value less than or equal to x.

There are two kind of association one is node to node and other is node to base station. This is chosen by mi where mi is the quantity of hubs used in ith time allotment by the information streams.And it is defined as

$m_i = \min(m_{max} , |N|-\sum_{j=1}^{i-1} m\hat{}j])$

Where

$m\hat{}_j = \lceil (\ ) \rceil$ —

2

Where ceiling(x) (⌈ x ⌉) is the function where the input is a real number x and the output is the smallest integer value greater than or equal to x.

Delay calculation is given by

$T = t_1 + t_2$

t_1 = in this time-slot m_{max} node are utilized

t_1 $\begin{cases} \lfloor 2(|N|-m_{max})\,(m_{max}+1) + 1 \rfloor & \text{, if } m_{max} \text{ is odd,} \\ \lfloor 2(|N|-m_{ma} \ m_{max} + 1 \rfloor & , \quad \text{if } m_{max} \text{ even.} \end{cases}$

t_2 = in this all the remaining data gathering process of the current data stream by using DADCN

α-Ring:

it is the type of ring structure which is formed when the following condition satisfies:

$|N_\alpha| \geq 2s$

Where $|N_\alpha|$ is the total number of nodes and s is the number of data streams.

In α-ring the t_1 is the time taken by the nodes to collect data from $|N_\alpha|$-1 node in to a single node. Such node takes 1 time-slot to aggregate data to the base station.

Let us consider there are $|N_\alpha|$ node give as $\{n_1,n_2,n_3,\ldots\ldots\ldots,n_N\alpha\}$. In the interval where $T<t_1$ node n_{c1} in the s^{th} data collection process data to node n_{c2} and the n_{c2} will fuse the data with its own and this will form a ring structure and this structure is called α-ring structure. where c_1,c_2 are define below

$c_1 = (1 + \text{mod}\ (2*(s - 1) + T - 1, |N\alpha|))$, $c_2 = (1 + \text{mod}\ (2*(s - 1) + T, |N\alpha|))$.

At time-slot $t = t_1 + 1$, there are $|N_\alpha| - t_1$ nodes in an α-ring waiting to transmit their data and data from these $|N\alpha| - t_1$ nodes will then be collected using the DADCNS, which will take total t_2 time-slots.

Consider an example of α-ring is as shown below

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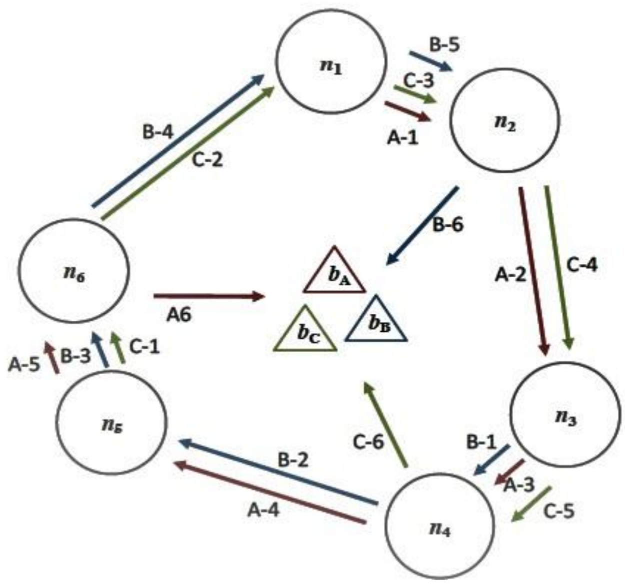


Fig.2.1 *α-ring* when the value of |N| = 6 and streams s = 3

In this total number of nodes $|N_\alpha|$ = 6 and number of data stream (s) = 3. Therefore, m_{max}=2. This shows that for t_1 time-slot maximum nodes used by data stream are 2.

Let us assume that the name of streams are {A, B, C} and these streams are divided in to six parts.

For 1st time-slot A_1 uses node n_1 and n_2 whereas B_1 use node n_3 and n_4 and C_1 uses n_5 and n_6. In the same manner for 2nd time-slot A_2 uses node n_2 and n_3 whereas B_2 use node n_4 and n_5 and C_2 uses n_6 and n_1. This node-to node connection is there for five- time slot and finally at the sixth time-slot the data is finalized then be composed together using the

DADCNS, which will remain for t_2 time-slots and aggregated at the base-station at the end.

$T = t_1 + t_2 = 5 + 1 = 6$

Data collection tree for α-ring :

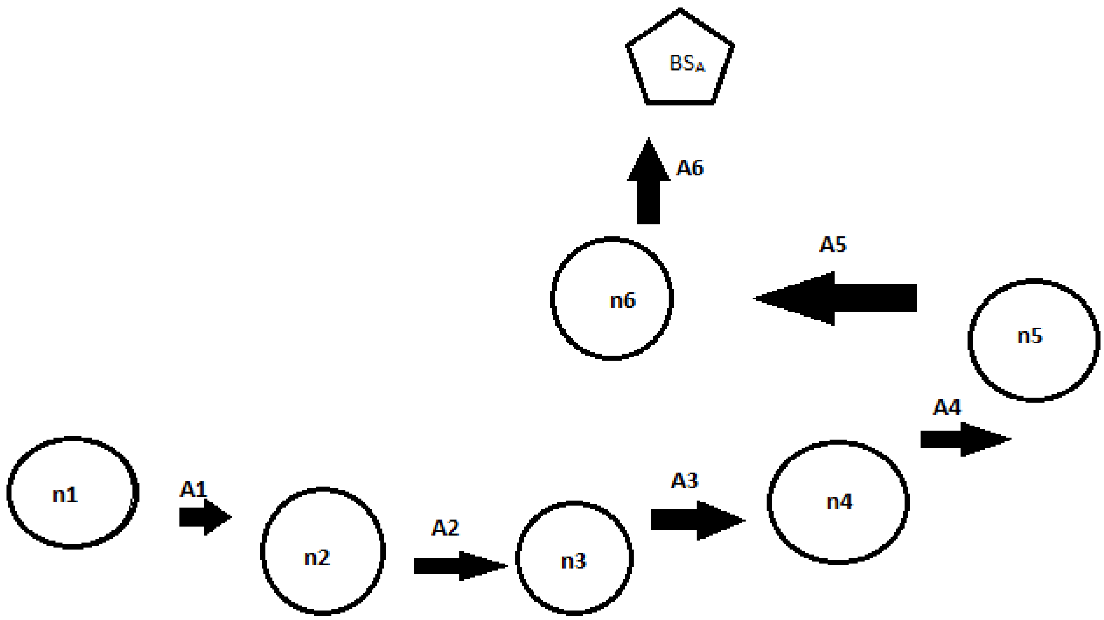


Fig 2.2.1 Data collection tree for Stream A

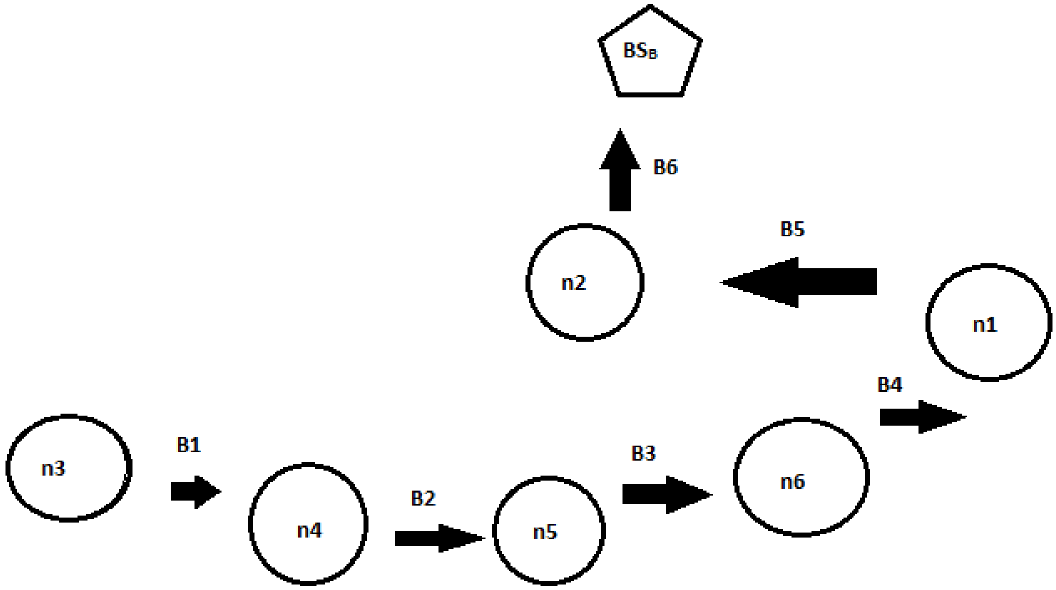


Fig. 2.2.2 Data collection tree for stream B

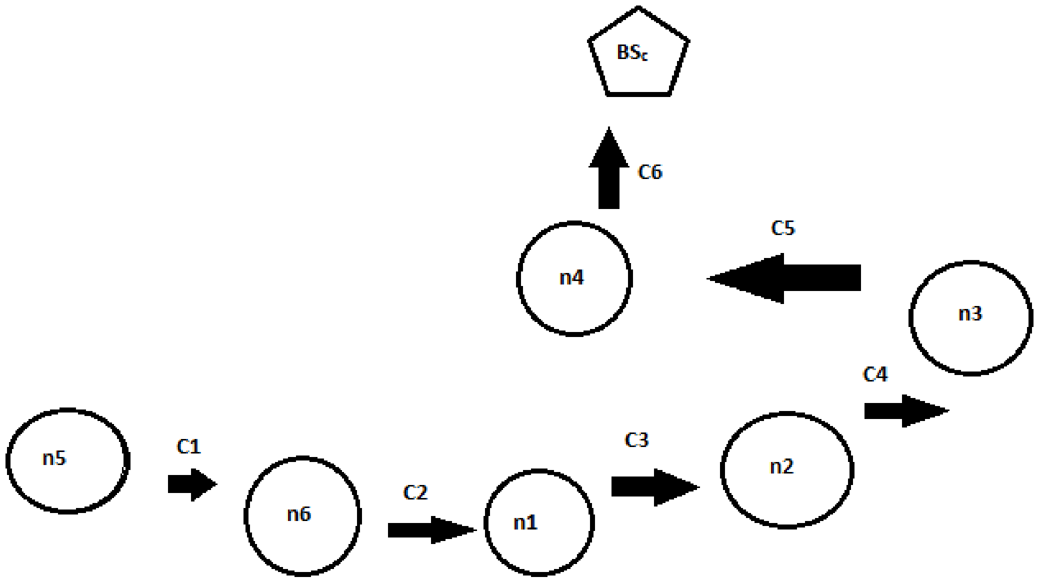


Fig 2.2.3 Data collection Tree for Stream C

β-ring:

it is the type of ring structure which is formed when the following condition satisfies:

$|N_\beta| \geq 3s$

Where |N| is the total number of nodes and s is the number of data streams. In this the communication is N2N and N2base-station.

Let us consider there are $|N_\beta|$ node give as $\{n_1,n_2,n_3,\ldots\ldots\ldots,n_{N\beta}\}$. In the interval where $T<t_1$ node n_{c3} in the s^{th} data gathering process data send to node n_{c4} and the n_{c5} will involve in node to base station communication and this will form a ring structure and this structure is called *β-ring* structure. Where c_1,c_2,c_3 are define below

$c_3 = (1 + \mathrm{mod}\ (3(s-1) + 2*(T-1), |N_\beta|)),$

$c_4 = (1 + \mathrm{mod}\ (3(s-1) + 2*(T-1)+1, |N_\beta|)),$

$c_5 = (1 + \mathrm{mod}\ (3(s-1) + 2*(T-1) + 2; |N_\beta|));$

Example of β-ring is as shown :

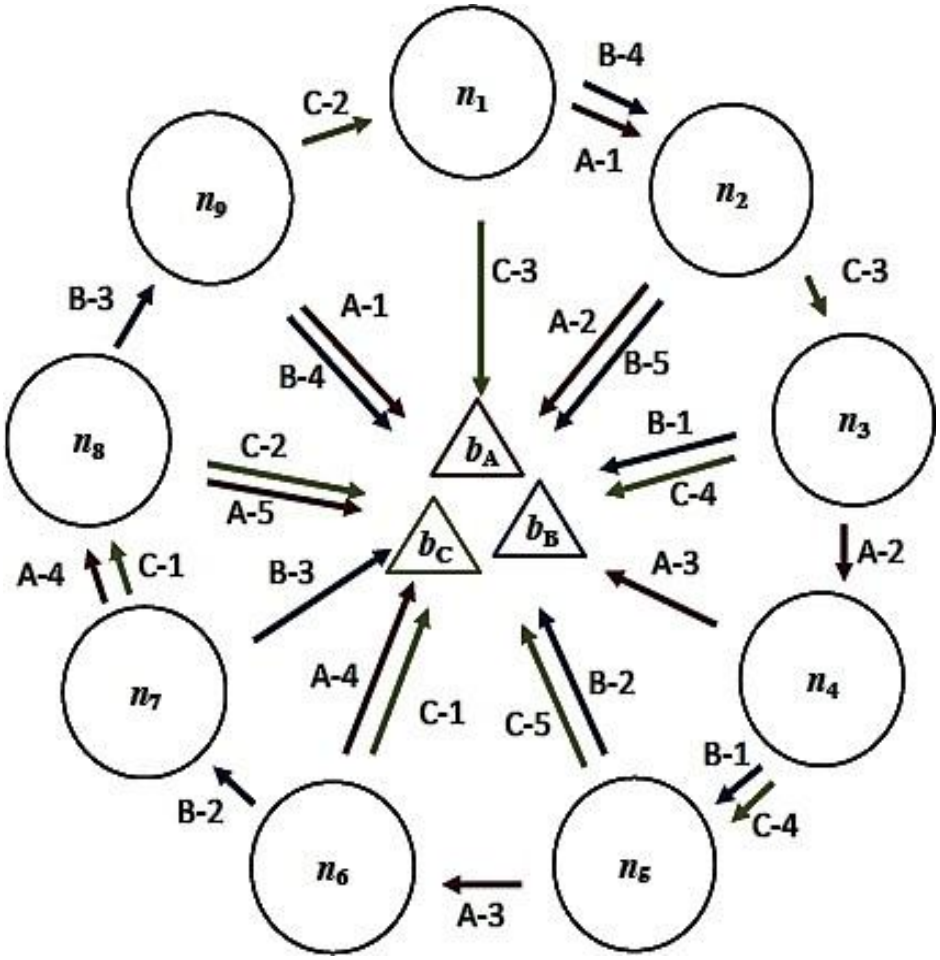


Fig 2.3 *β-ring* when |N|=9 and the streams s = 3

Consider an example of β-ring is as shown in fig where total number of nodes $|N_\beta|$ = 9 and number of data stream (s) = 3. Therefore, m_{max}=3. This shows that for t_1 time- slot maximum nodes used by data stream are 3.

Let us assume that the name of streams is {A, B, C} and these streams are divided in to 5 parts.

for 1st time-slot A_1 uses node n_1 and n_2 which is node to node communication and n_9 is sending data to base station which is node to base station communication similarly B_1 use node n_4 and n_5 for node to node communication and n_3 to base station and C_1 uses n_7 and n_8 for node to node communication and n_6 for node to base station communication. In the same manner for 2nd time-slot A_2 uses node n_3 and n_4 for node to node and n_2 for node to base station whereas B_2 use node n_6, n_7 and n_5 and C_2 uses n_9, n_1 and n_8. This node-to node and node to base station communication is there for four-time slot and finally at the fifth time-slot there is only node to base communication where data is to be processed using the DADCNS and it will last for t_2 time-slots and aggregated at the base-station at the end.

$T = t_1 + t_2 = 4 + 1= 5$

Data collection tree for *β*-ring :

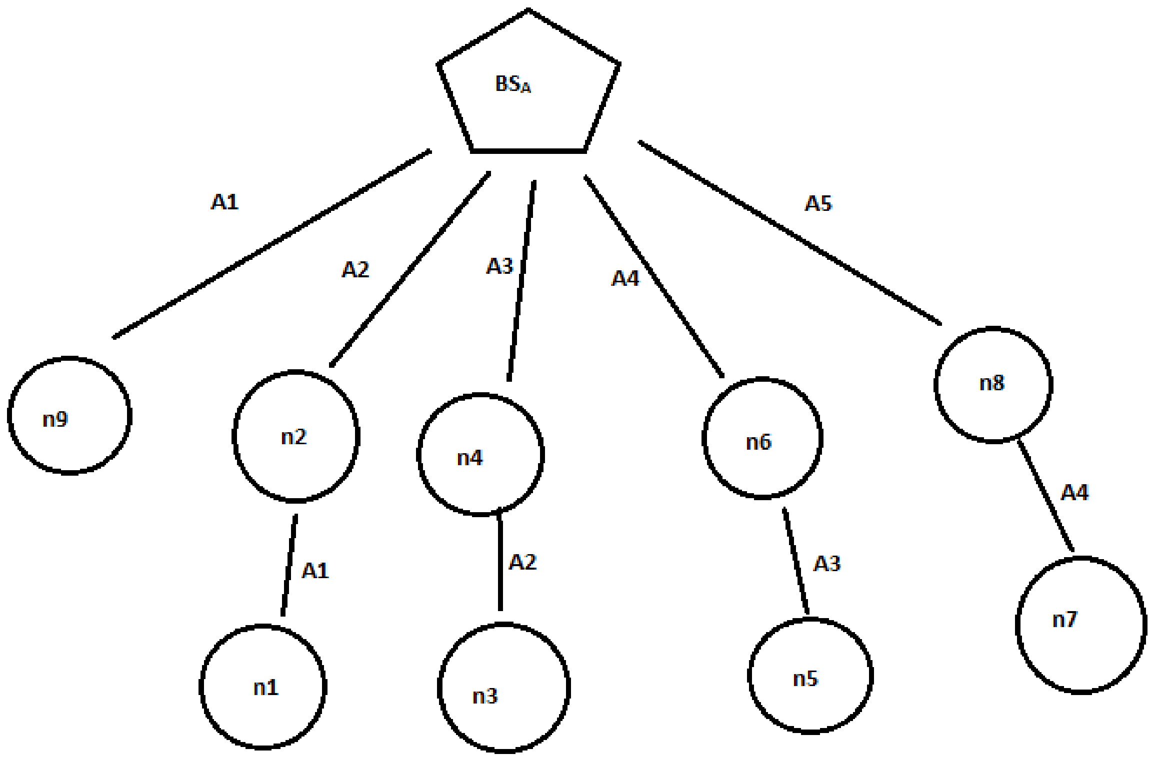


Fig 2.4.1 Data collection tree for stream

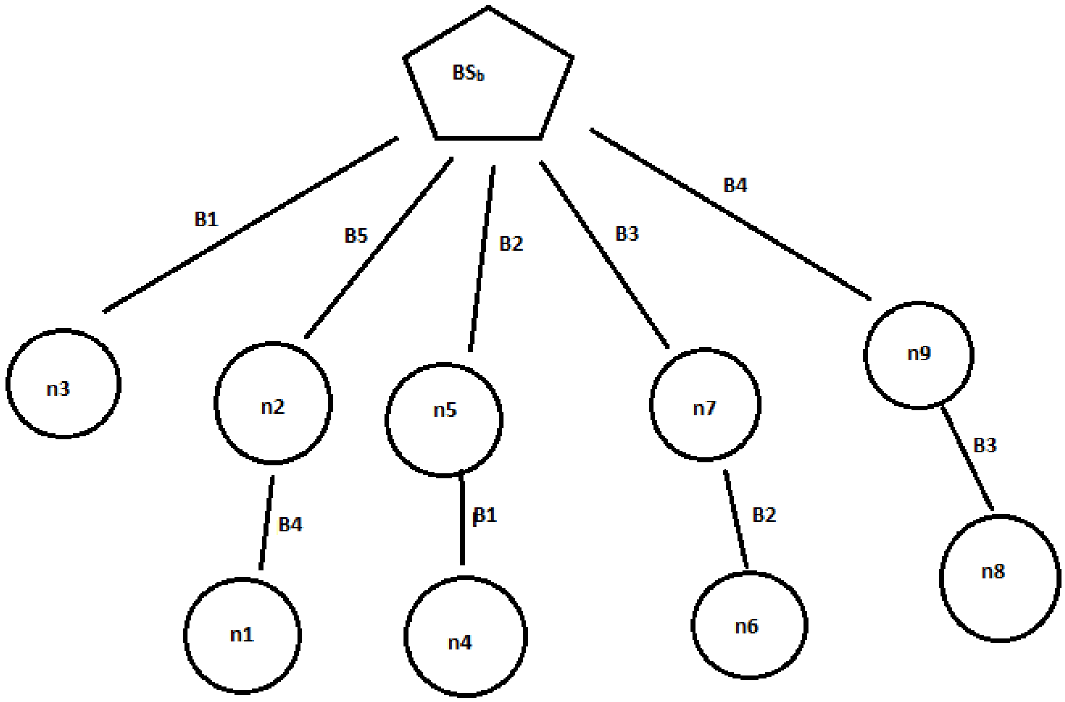


Fig 2.4.2 Data collection tree for stream

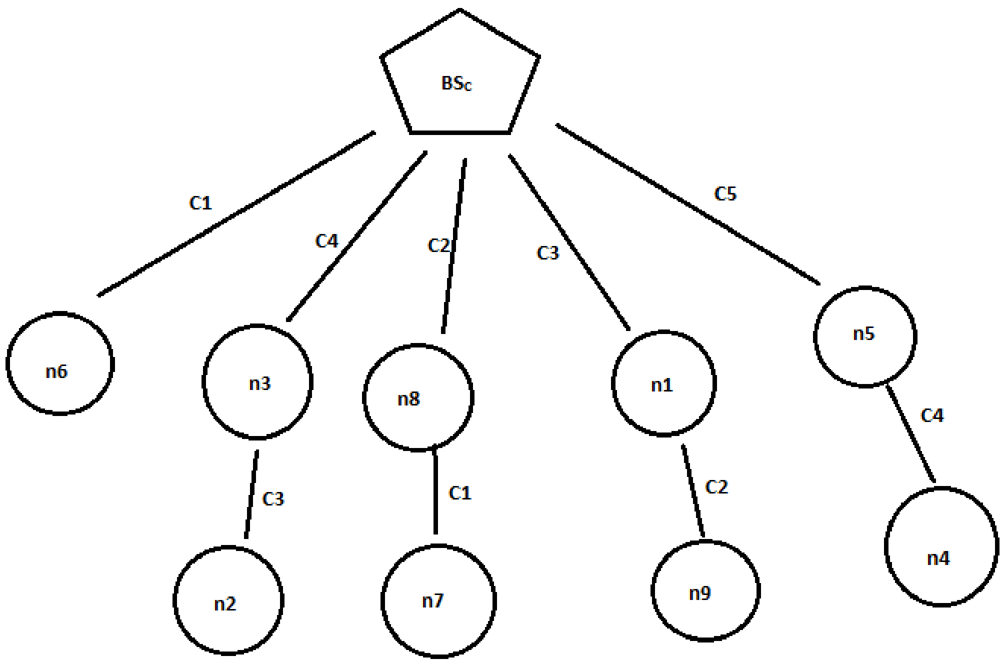


Fig 2.4.3 Data collection tree for stream

MULTIPLE RINGS:

For cases with $m_{max} > 3$, different sized multiple α and β rings are needed.

Case 1- m_{max} is even and >= 4:

$n_\alpha = \; m_{max}/2$

no. of 'α' rings are produced. Every α- ring will be first allocated with 2*s no. of* nodes. Remaining | N | - n_α (2s) nodes are then allotted to the n_α rings sequentially. Difference in α-ring size will be less than 1 between two arbitrary rings. Two nodes are used by the data stream of every α-ring. At time $T_1 + 1$ remaining nodes will be ready to submit the information. Data is retrieved easily among these nodes using T_2 time slots.

Case 2 – m_{max} is odd and >= 5:

In this one β ring and $n'_\alpha = (m_{max} – 3)/2$ no. of α-rings are produced. At the beginning 2s nodes are allocated for each α ring whereas 3k nodes are allocated for every β ring.

The remaining $| N | - 3s_{BS} – n'_\alpha (2s_{BS})$ nodes are allotted to the β ring until $| N_\beta | = 2t_1 + 1$. The remaining nodes are allocated to the α ring sequentially. β rings are filled up before the α rings because β rings reduces the data collection time for same no. of nodes as it takes lesser time. Furthermore, all of its Node-to-Node communications are accomplished in the 1st t1 time-slots, as the highest β ring size is restricted to $2t_1 + 1$.

For | N_β | = $2t_1$ + 1, the network m_{max} nodes in first T1 slots, while remaining nodes will take T2 time-slots.

the two algorithms.

PERFORMANCE ANALYSIS

The exact distinction in execution regarding schedule openings taken by the framework to gather information from the tree and afterward transmitting it to the Base Stations can be figured simply in the wake of deciding precise and exact estimations of time taken for the new proposed algorithm to transmit and share information.

Be that as it may, as plainly referenced in the first algorithm, the time taken by a β ring to gather information and transmit it to BS is not as much as time taken by a α ring.Using this as the basis, we can arrive at an estimated result.

The original algorithm, in case of multiple rings, aims to generate as many number of α rings as possible under the conditions of N and k, and in any given case will produce at most one β ring.

The new proposed algorithm heavily differs from the original one as it is exactly opposite. In any given case, it aims to produce maximum number of β rings for a given value of N and k, while forming at most one α ring if necessary.

Since the new proposed algorithm produces far more number of β rings and less number of α rings, hence it is self-explanatory that the new proposed algorithm will be much more efficient as a β ring is more efficient than an α ring.

But the exact difference between the two algorithms will be clear once the precise time slots required to collect data are computed.

The execution of the proposed system structure is additionally examined utilizing PC recreations. In the recreations, the term of an information gathering process T with k simultaneous streams is utilized as the execution marker. T is communicated as the all out number of timeslots required by the BS of various streams to gather information from every one of the hubs in the system. In every reenactment, a system with IoT hubs is considered. In the tests, execution of the first the original algorithm will be utilized as a source of perspective. So as to assess the impact of and k to the execution of systems with various system structures, is fluctuated from 0 to 300 with a stage size of 15 while k is shifted from 2 to 10. Results are appeared in the figures beneath.

Comparative graphs for different values for N and k

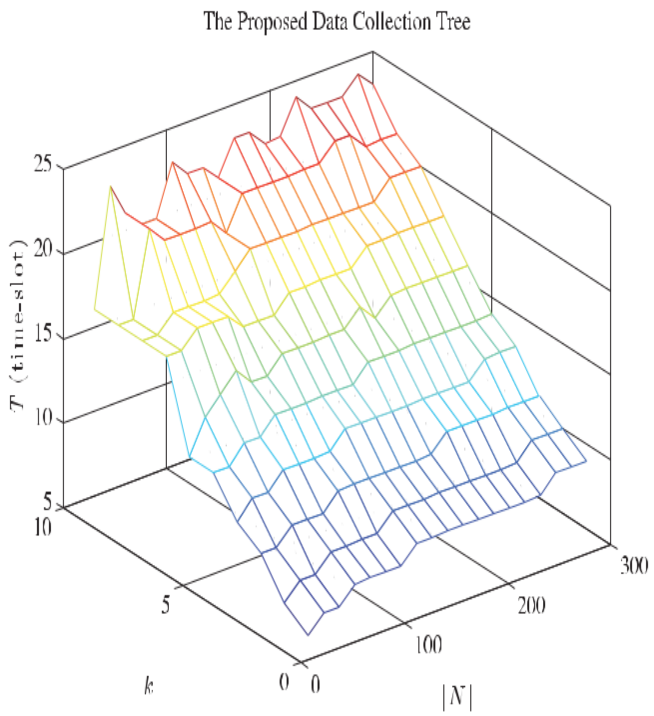


Fig. 3. Data collection durations of the proposed data collection tree in networks with |*N* | nodes and *k* concurrent data streams.

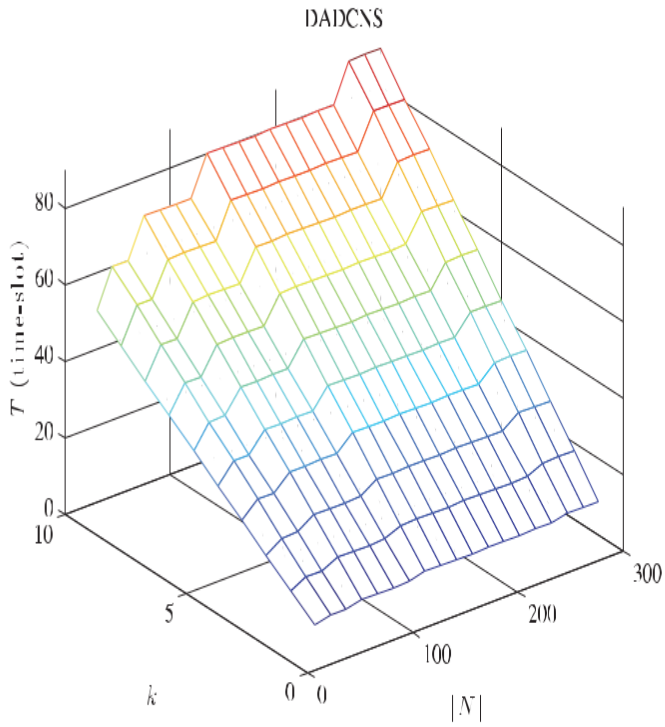


Fig. 4. Data collection durations of the DADCNS in networks data with |*N* | nodes and *k* data concurrent data streams.

The above graphs represent the time taken for initial accumulation of data (t1) for the original as well as the proposed algorithms and it shows conclusively that for the variety of values of N and k taken and the cases considered, keeping all other factors constant, the proposed algorithm performs better than the original algorithm and saves upto 30% time in the data aggregation process, which for any WSN is a huge efficiency boost.

The graph for time of the proposed algorithm flat lines after a time for any number of nodes, keeping the value of k as the same and this shows the overall efficiency of the algorithm and its ability to handle high-density networks

The time taken by the two algorithms to accumulate the data can be compared more clearly by fixing the value of k and then calculating the time taken as a function of N.

The time taken (t1) is plotted against the number of nodes (N) for 3 different values of k, i.e k=4, k=6 & k=9.

Time comparison of original and proposed algorithms for different values of N keeping k constant

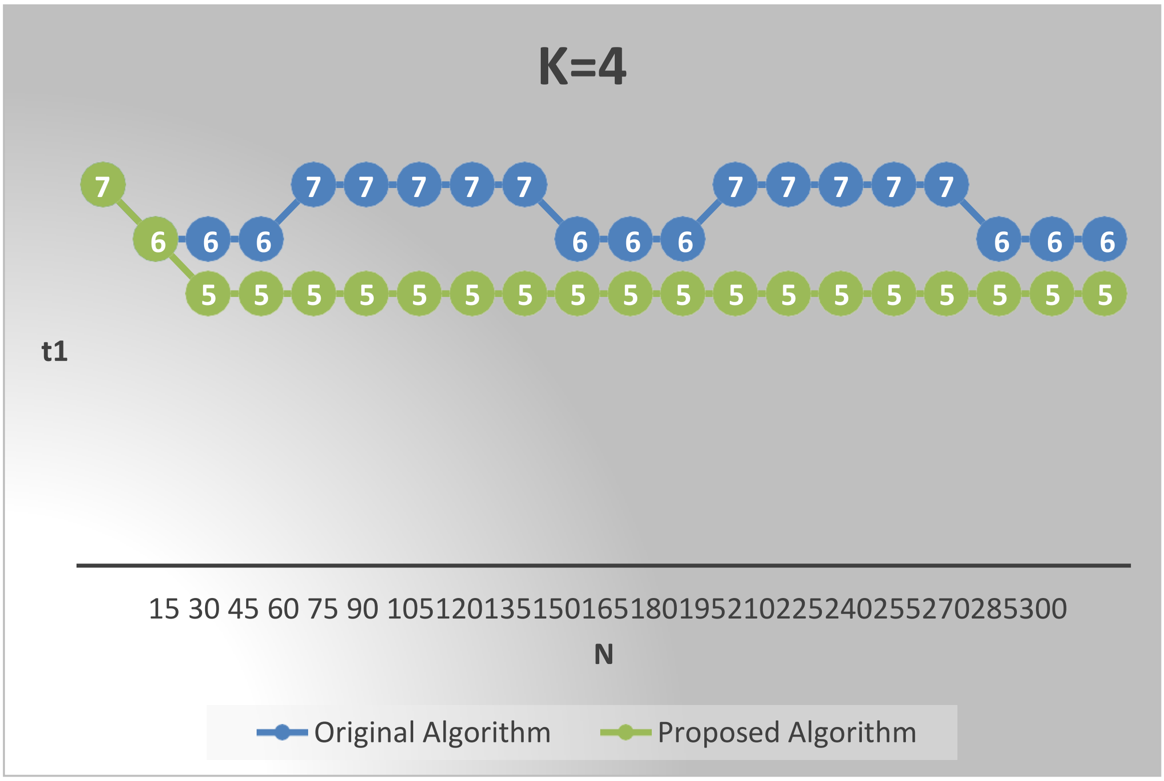


Fig 27 (a) K=4

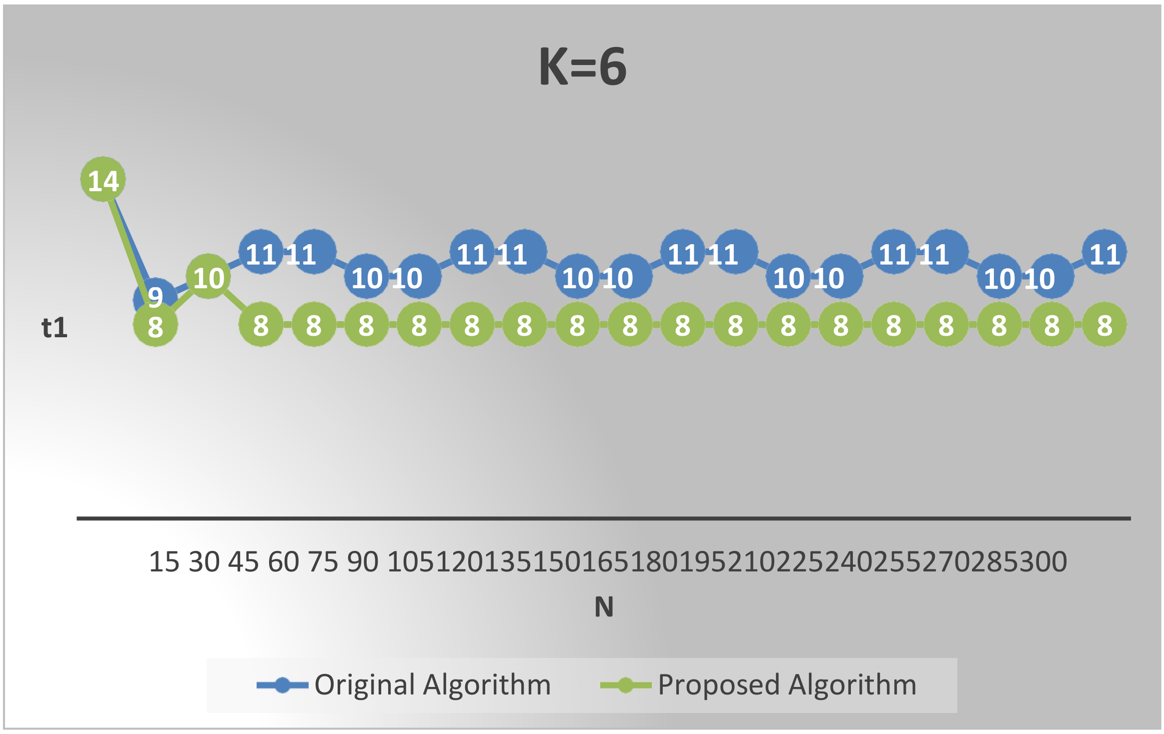


Fig 27 (b) K=6

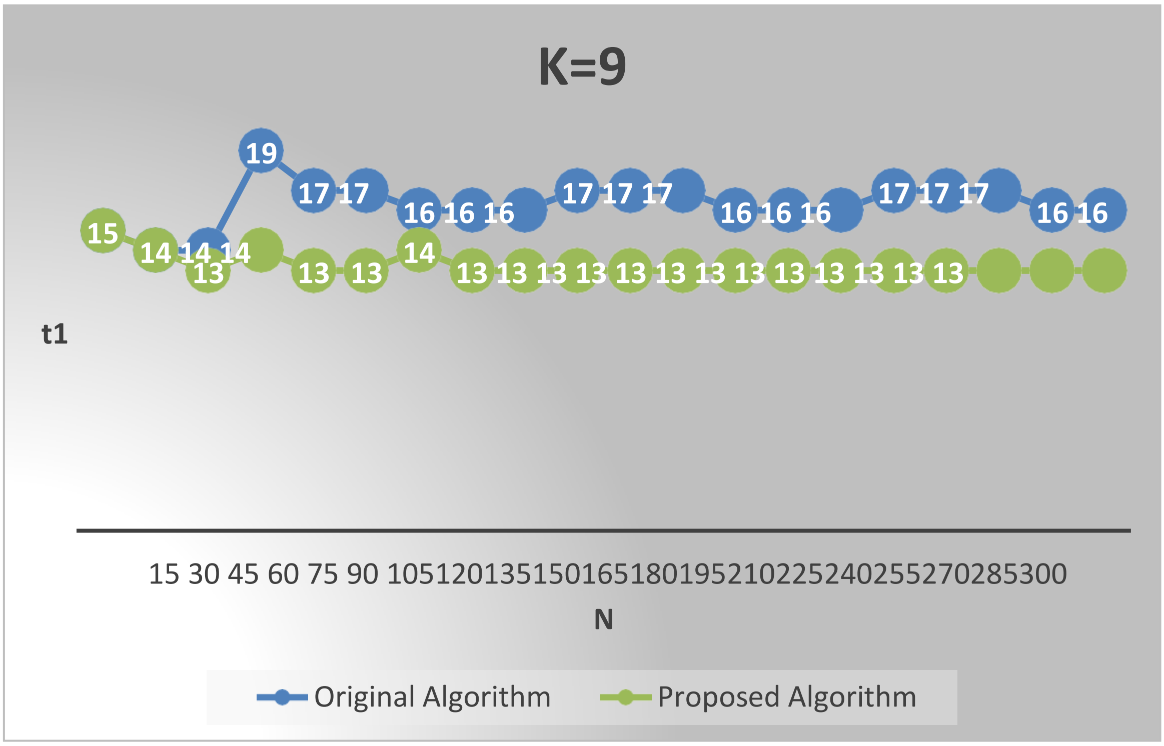


Fig 27 (c) K = 9

Conclusion

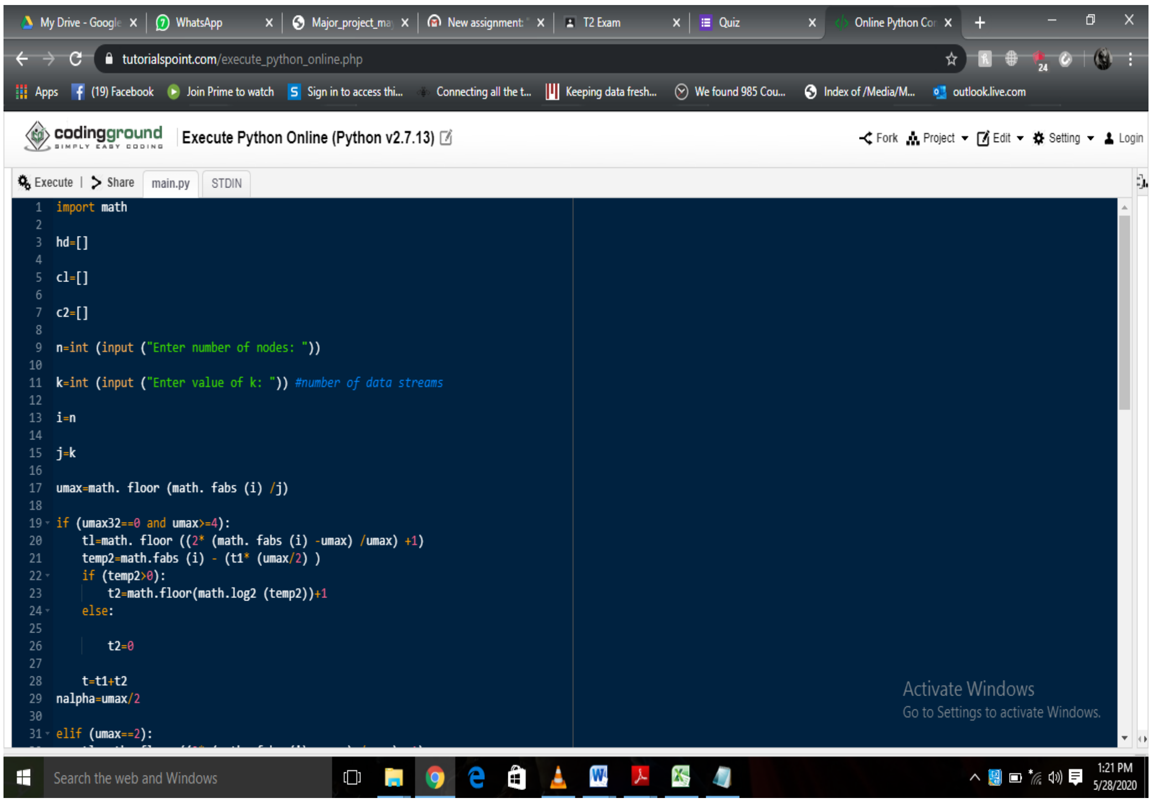
Hence the original algorithm, that has established a new concept to efficiently collect data from IOT networks using special kinds of rings, has been modified and working on the similar principal a new set of procedure is proposed that differs in the structure and distribution of these special rings to further improve the time requirement of the process.

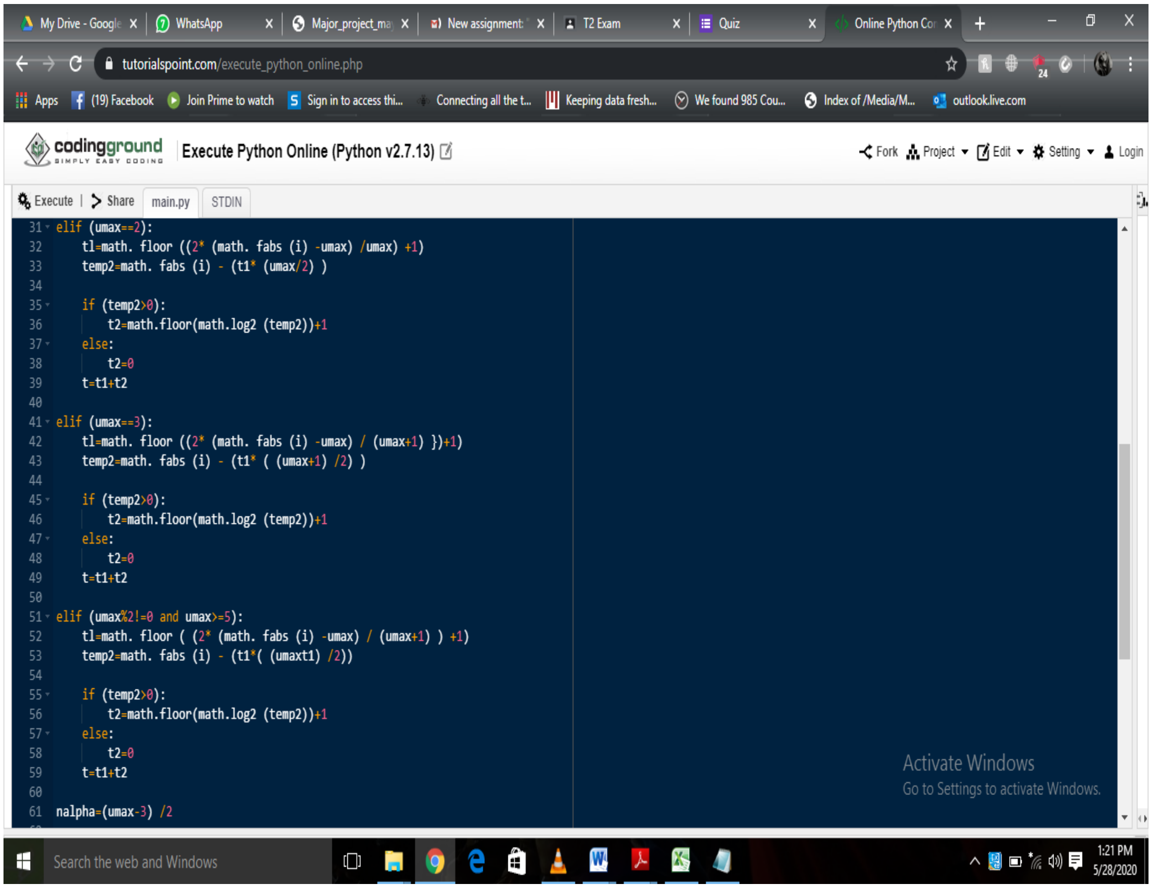
Future Scope:

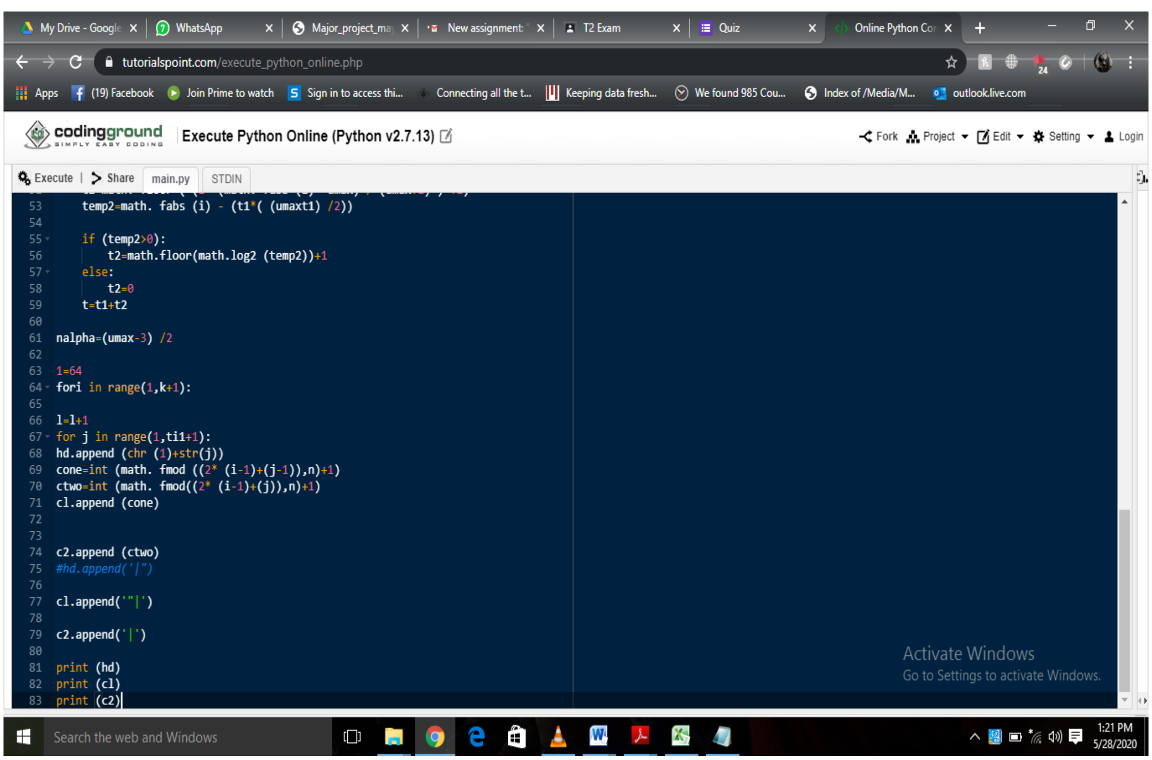
It has been established that the new proposed algorithm is more efficient than the original one based on the basic principles that are formulated to design these algorithms.

Furthermore, some work may be done to improve the time required to collect aggregated data from all nodes and send it across to the base station.

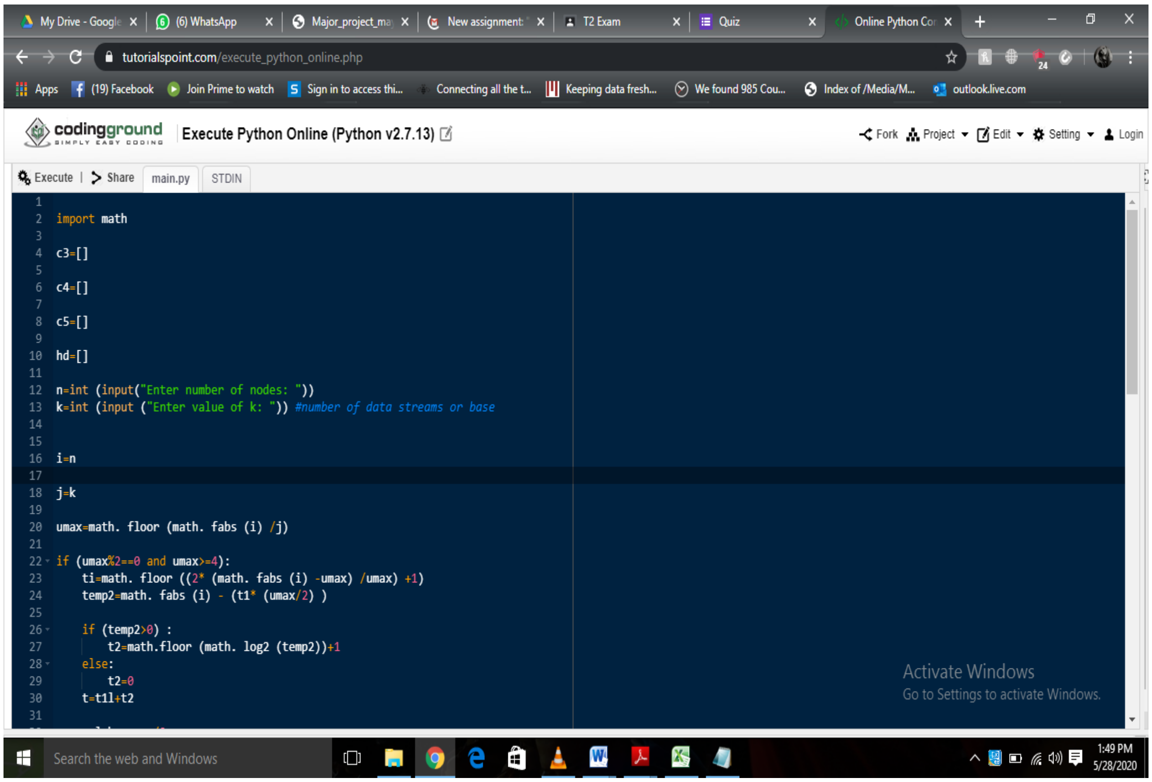
Code for Calculating Time Slots and Data Streams Alpha Ring

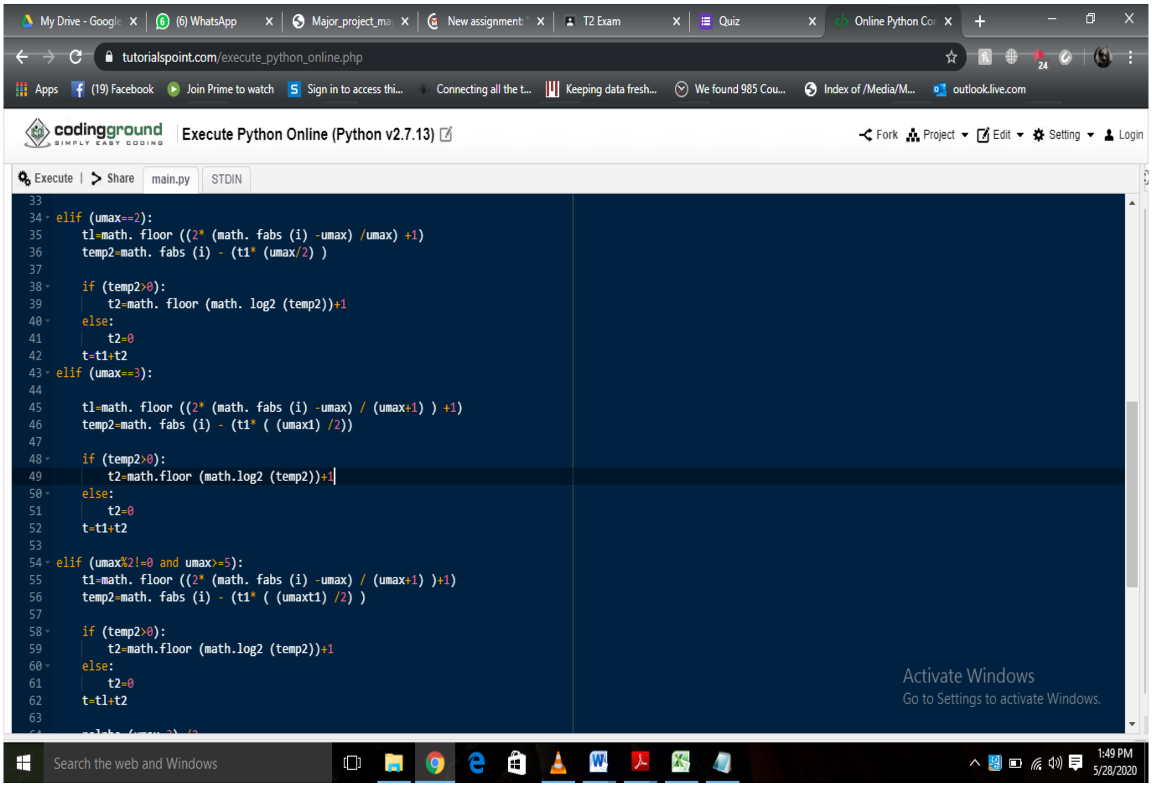


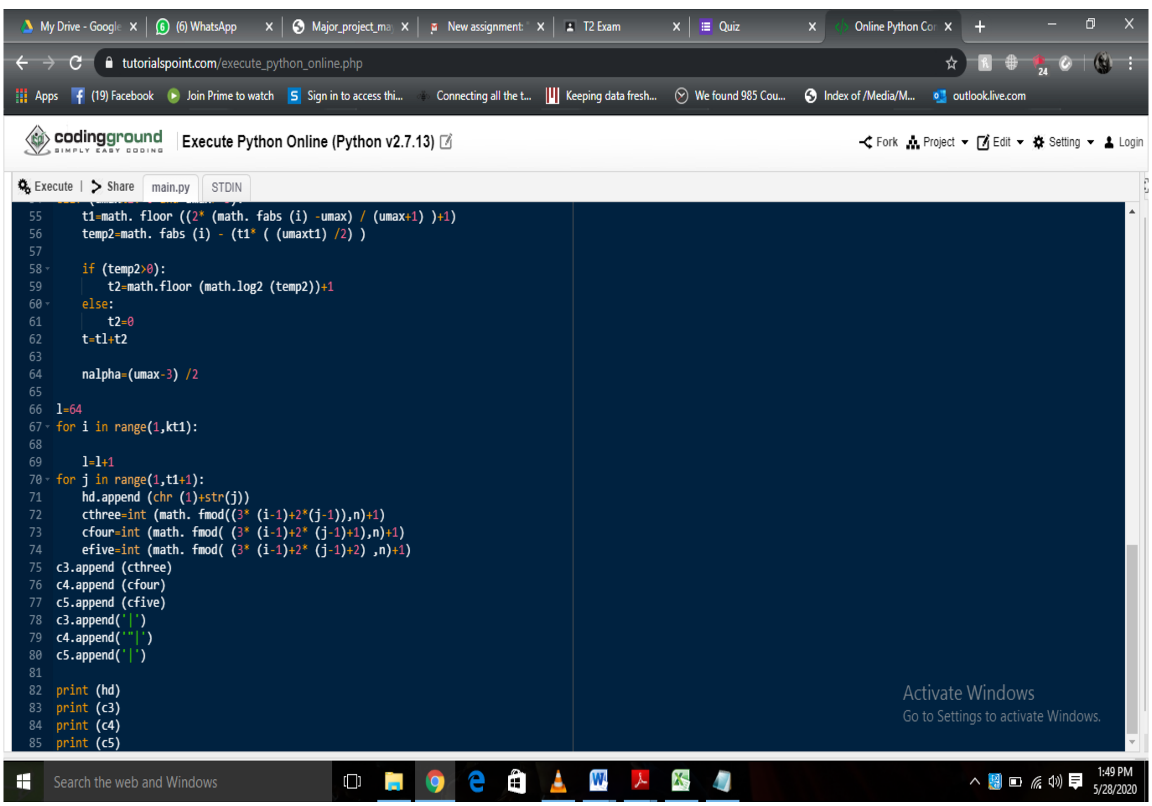

Execute Python Online (Python v2.7.13)
elif (umax==2):
t1=math. floor ((2* (math. fabs (i) -umax) /umax) +1)
temp2=math. fabs (i) - (t1* (umax/2))
if (temp2>0):
t2=math.floor(math.log2 (temp2))+1
else:
t2=0
t=t1+t2
elif (umax==3):
t1=math. floor ((2* (math. fabs (i) -umax) / (umax+1) })+1)
temp2=math. fabs (i) - (t1* ((umax+1) /2))
if (temp2>0):
t2=math.floor(math.log2 (temp2))+1
else:
t2=0
t=t1+t2
elif (umax%2!=0 and umax>=5):
t1=math. floor ((2* (math. fabs (i) -umax) / (umax+1)) +1)
temp2=math. fabs (i) - (t1*((umaxt1) /2))
if (temp2>0):
t2=math.floor(math.log2 (temp2))+1
else:
t2=0
t=t1+t2
nalpha=(umax-3) /2


Execute Python Online (Python v2.7.13)
temp2=math. fabs (i) - (t1*((umaxt1) /2))
if (temp2>0):
t2=math.floor(math.log2 (temp2))+1
else:
t2=0
t=t1+t2
nalpha=(umax-3) /2
1=64
fori in range(1,k+1):
l=l+1
for j in range(1,ti1+1):
hd.append (chr (1)+str(j))
cone=int (math. fmod ((2* (i-1)+(j-1)),n)+1)
ctwo=int (math. fmod((2* (i-1)+(j)),n)+1)
c1.append (cone)
c2.append (ctwo)
#hd.append('|')
c1.append('"|')
c2.append('|')
print (hd)
print (c1)
print (c2)

Beta Ring


codingground
Execute Python Online (Python v2.7.13)
import math
c3=[]
c4=[]
c5=[]
hd=[]
n=int (input("Enter number of nodes: "))
k=int (input ("Enter value of k: ")) #number of data streams or base
i=n
j=k
umax=math. floor (math. fabs (i) /j)
if (umax%2==0 and umax>=4):
ti=math. floor ((2* (math. fabs (i) -umax) /umax) +1)
temp2=math. fabs (i) - (t1* (umax/2))
if (temp2>0) :
t2=math.floor (math. log2 (temp2))+1
else:
t2=0
t=t1+t2


Execute Python Online (Python v2.7.13)
Execute
Share
main.py
STDIN
elif (umax==2):
tl=math. floor ((2* (math. fabs (i) -umax) /umax) +1)
temp2=math. fabs (i) - (t1* (umax/2))
if (temp2>0):
t2=math. floor (math. log2 (temp2))+1
else:
t2=0
t=t1+t2
elif (umax==3):
tl=math. floor ((2* (math. fabs (i) -umax) / (umax+1)) +1)
temp2=math. fabs (i) - (t1* ((umax1) /2))
if (temp2>0):
t2=math.floor (math.log2 (temp2))+1
else:
t2=0
t=t1+t2
elif (umax%2!=0 and umax>=5):
t1=math. floor ((2* (math. fabs (i) -umax) / (umax+1))+1)
temp2=math. fabs (i) - (t1* ((umaxt1) /2))
if (temp2>0):
t2=math.floor (math.log2 (temp2))+1
else:
t2=0
t=tl+t2
Activate Windows
Go to Settings to activate Windows.


Execute Python Online (Python v2.7.13)
Execute
Share
main.py
STDIN
t1=math. floor ((2* (math. fabs (i) -umax) / (umax+1))+1)
temp2=math. fabs (i) - (t1* ((umaxt1) /2))
if (temp2>0):
t2=math.floor (math.log2 (temp2))+1
else:
t2=0
t=tl+t2
nalpha=(umax-3) /2
l=64
for i in range(1,kt1):
l=l+1
for j in range(1,t1+1):
hd.append (chr (1)+str(j))
cthree=int (math. fmod((3* (i-1)+2*(j-1)),n)+1)
cfour=int (math. fmod((3* (i-1)+2* (j-1)+1),n)+1)
efive=int (math. fmod((3* (i-1)+2* (j-1)+2) ,n)+1)
c3.append (cthree)
c4.append (cfour)
c5.append (cfive)
c3.append('|')
c4.append('"|')
c5.append('|')
print (hd)
print (c3)
print (c4)
print (c5)
Activate Windows
Go to Settings to activate Windows.

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Minimization of time Delay Using Ring Structure in IOT

Project report submitted in partial fulfillment of the requirement for the degree of Bachelor of Technology

in

Computer Science and Engineering/Information Technology

By

Ankit Srivastava(161254)
Laxit Rana(161278)

Under the supervision of

Mr. Arvind Kumar

tO

Department of Computer Science & Engineering and Information Technology
Jaypee University of Information Technology Waknaghat, SoIan-173234,
Himachal Pradesh

Candidate's Declaration

1 hereby declare that the work resented in this report entitled **Minimization of time Delay Using Ring Structure in IOT** in partial fulfillment of the requirements for the award of the degree of **Bachelor of Technology** in **Computer Science and Engineering/Information Technology** submitted in the department of Computer Science & Eng ring and Information

Technology, Jaypee University of Information Technology Waknaghat is an authentic record of my own work carried out ox'er a peri‹xl from August 2019 to May 2020 under the superx'ision of **Mr. Arvind** Kumar Asst. Professor Computer Science & Engineering.

The matter embodied in the report has not been submitted for the award of any other degree or diploma.

(Student Signature)
Ankit Srivastava
16 1 284

Laxit Rana
16 1 278

This is to certify that the above statement made by the candidate is true to the best of my knowledge.

(Supervisor Signature)
Mr. Arvind Kumar
Asst. Professor
Computer Science & Engineering
Dated: 25/05/2020

ACKNOWLEDGEMENT

We would like to express our special thanks o)' gratitude to our Project Super •i.for Mr. Ar •im1 Kumar who gave us the golden opportunity to do this wonderful project on the topic minimization of time Delay Using Ring Structure in IOT, *which al.so helped u.s in doing a lot oJ'Re.search and we came to know ahout .so many new thing.s we are really thankJ'ul to them. Secondly we would al.so like to thank our parent.s and friend.s who helped u.s a lot in Jinaliz,ing thi.s project within the limited time frame.*

(Ankit Sri !a.sta !a)
(Laxit Rana)

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LIST OF ABBREVIATIONS

IEEE	Institute of Electrical and Electronics Engineers
IoT	Internet of Things
WSN	Wireless Sensor Network
CH	Cluster Head
CM	Cluster Member
DADCNS	Delay-Aware Data Collection Network Structure
CTP	Collection Tree Protocol
SC	Single Chain
ETX	Expected Transmissions
MST	Minimum Spanning Tree
SCH	Sub Cluster Head
IVP	Invitation Packet
RP	Rejecting Packet
CR	Connection Request
MAC	Media Access Control
CDMA	Code Division Multiple Access
DCT	Data Collection Time
MANET	Mobile Adhoc Netw ork
N2N	Node to Node
N2BS	Node to Base Station
N2N	Node to Node
MCU	Microcontroller Unit
TCR	Transceiver Unit

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PROJECT OBJ ECTIVES

1.1 Introduction

What is IoT?

The Internet of Things (IoT) is the system of numerous electronic and/or electrical gadgets, for example, physical gadgets, vehicles, gadgets , and different components that coordinate with hardware, pmgramming, sensors, actuators, and network between these gadgets Je can shoe these as a framework. This association offers the likelihood to interface, gather and trade information. This makes open doors for a more straightforward mix of the physical world into digital frameworks, which adds to expanding effectiveness, accomplishing financial advantages, and along these lines to a general decrease in general human exertion

The quantity of IoT gadgets expanded by 31°/r year-on-year to EUR 8.4 billion. It is assessed that 30 billion gadgets will be associated with such frameworks by 2020.

IoT not just includes associating gadgets generally associated with the Internet or different systems, for example, cell phones, tablets, PCs, PCs, and so forth., yet in addition interfacing gadgets that we customarily viewed as imbecilic gadgets, for example , coolers, siphons , and water and so on lights, fans, and other comparable gadgets, and when you consider it, the association between these gadgets opens up numerous new ways to the administrations that the IoT can give to diminish individuals' infringement, increment by and large solace and give surprising administrations . a couple of yenrs back

Thoughts like control lights, enthusiasts, fountains, and so forth., have turned into a reality that was beforehand part of sci-fi, or just conceivable with innovations that were past the scope of the majority, yet now they are available and moderate .

For wireless networks that offer time-touchy data on the fly, it's insufficient to transmit information rapidly. That information additionally should be new. Think about the numerous sensors in your vehicle. While it might take not exactly a second for most sensors to transmit an information bundle to a focal processor, the age of that information may change, contingent upon how much of the time a sensor is transferring readings.

In a perfect network, these sensors ought to have the option to transmit refreshes continually, giving the freshest, most current status for each quantifiable component, from tire strain to the nearness of obstructions. In any case , there's just so much information that a wireless channel can transmit without totally overpowering the network.

How, at that point, can a continually refres hing network — of sensors, automatons, or information sharing vehicles — limit the age of the data that it gets at any second, while simultaneously kee ping away from information bloc kage‘?

ABSTRACT

IoT system have a massive amount of smnrt devices which leads to maximization of massive amount of data. So to improve the performance of the IoT system our main task

time delay. In Normal wireless network delay is defined as the time taken for the amount of data to transfer from sender end to the receiver end. So in this a delay minimization technique is described for the wireless sensor network . In data collection tree the time taken to send data to destination is efficient but the uses the number of §-rings in less number of times which we can improve by generating another al gorithm which uses the basics of the concurrent data gathering tree with the advancement of maximizing the n-ring and §-ring as well. As §-ring take less time to transfer the data so the ma xiinization of §-ring will lead to minimization of delay.

In IoT arrange a great deal of gadgets cooperate. They create huge measures of information. Consequently, information gathering process turns into a central worry in extensive systems. Information gathering forms must use least measure of time while gathering information. In this paper a ring type network ructure is used where the nodes are arranged in the form such that data is collected by the n‹xles and then send to the base station. A ring network topology is further represented in the form of a tree where root is the base station and other nodes nre the pnrt of the tree. The ring structure is divided in to two parts o-Ring and §-ring. In this paper they use the number of alpha rings more and it causes increase in delay. To solve this problem, we are trying to design an approach which is proposed as an algorithm in this project.

It is the tree structure used to collect data from vnious places. It consists of node and base station. Each node can communicate with the another node at any time and the time taken to communicate is to be considered zero for the calculation of delay.

Let us consider a network structure N which have n number of nodes and A base station B which nre of b number of time .

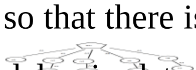
N= (n I , nv , ns , ... n times)

B = ib›, b,, b,,   b. ii e

In this structure the data is collected using ring topology where the nodes are collected in the shape of ring and each node is going to collect the data and send that data to the base station. the Data is collected in the form of streams and these streams were fuse using the nodes and after fusing data it is sent in to base station. Each data is fused before forwarding that data in to its pnrent.

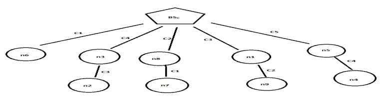
Let us suppose that single put of stream takes one-unit time-slot and the time taken to fuse the data is negligible. The data is aggregated using base station and each stream has its own base station for the aggregation of data.

Assume there are s data streams. These data streams are arranged in such manner so every stream be gins at same time allotment and ends at same time allotment. As data is gathered equal so the number of nodes utilized by every datum stream is same and most extreme so that there is no inconsistency in collection of data just as less time

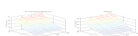


delay in data collection. To choose the greatest number of nodes if Total number of nodes present are lNl and the streams are s than the most extreme nodes use by every datum stream is where in floor(x) ([x j) is the characteristic that takes as enter an actual quantity x and gives an output which returns the inte ger value less than or equal to x.

There are two kind of association one is node to node and other is node to base station. This is chosen by mi where mi is the quantity of hubs used in ith time allotment by the information streams.And it is defined as



j=1



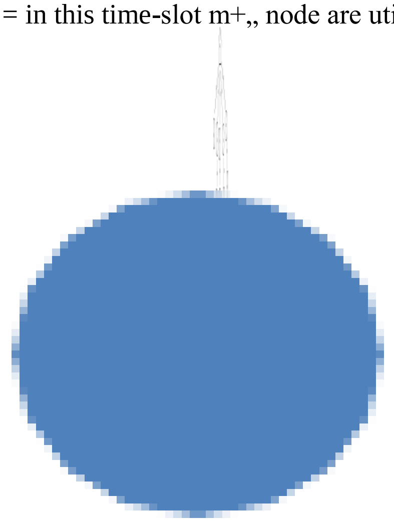
Where ceiling(x) ([x 1 ' the function where the input is a real number x and the output is the smallest integer value greater than or equal to x.

Delay calculation is given by

T = t i +tz

t i = in this time-slot m+,, node are utilized

ti



tz = in this all the remaining data gathering pmcess of the current data stream by using DADCN

o-Ring:

it is the type of ring structure which is formed when the following condition satisfies:

IN | > 2s

Where lN,l is the total number of nodes and s is the number of data streams.

In o-ring the t i is the time taken by the nodes to collect data from IN I- l node in to a single node. Such node takes l time-slot to aggregate data to the base station.

Let us consider there we lN,l me give as (ni r›,ns,. ... .,new}. In the interval where T<t i node n‹i in the s'h data collection process data to nude n‹z and the n‹z will fuse the data with its own and this will form a ring structure and this structure is called n-ring structure. where c i ,cz ore define below

ci = (l + mod (2*(s — l) + T — 1, |Nn|)), c› = (l

mod (2*(s — l) T, |No|)).

At time-slot t = t i + l , there are IN | — ti ides in n-ring waiting to transmit their data and data from these |No| — t i nodes will then be collected using the DADCNS, which will take total tz time-slots.

7 I I' a c

Consider an example of n-ring is as shown below

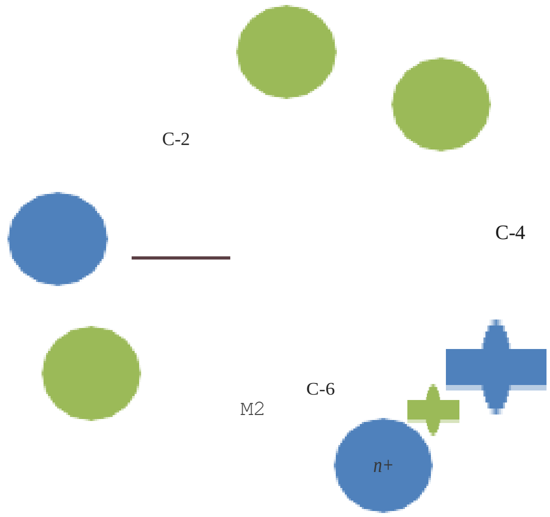


Fig.2.1 *x-ring* when the value of lNl = 6 and streams s = 3

In this total number of nodes IN I = 6 and number of data stream (s) = 3. Therefore , m+, =2. This shows that for t i time -slot maximum nodes used by data stream are 2.

Let us assume that the name of streams are (A, B , C} and these streams ore divided in to six parts.

For 1" time-slot A i uses node ni and nz whereas B i use node ns and re and Ci uses ns and n‹,. In the same manner for '“ time-slot Az uses node nz and na whereas Bz use node n‹ and ns and Cz uses n‹, and ni . This node-to node connection is there for five- time slot and finally at the sixth time-slot the data is finalized then be composed together using the

DADCNS, which will remain for tz time-slots and aggregated at the base-station at the end.

$$T = t\ i + tz = 5 + l = 6$$

Data collection tree for n-ring :

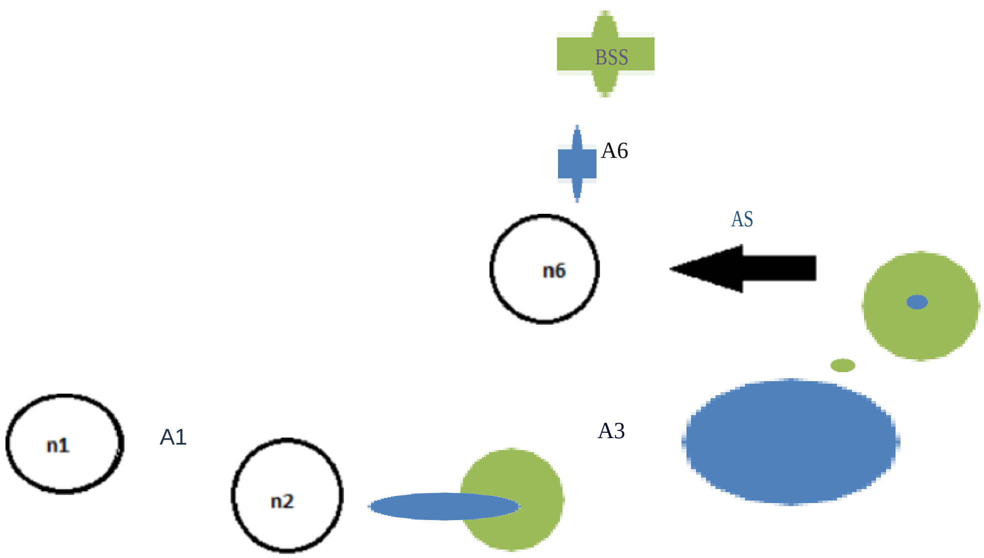


Fig 2.2.1 Data collection tree for Stream A

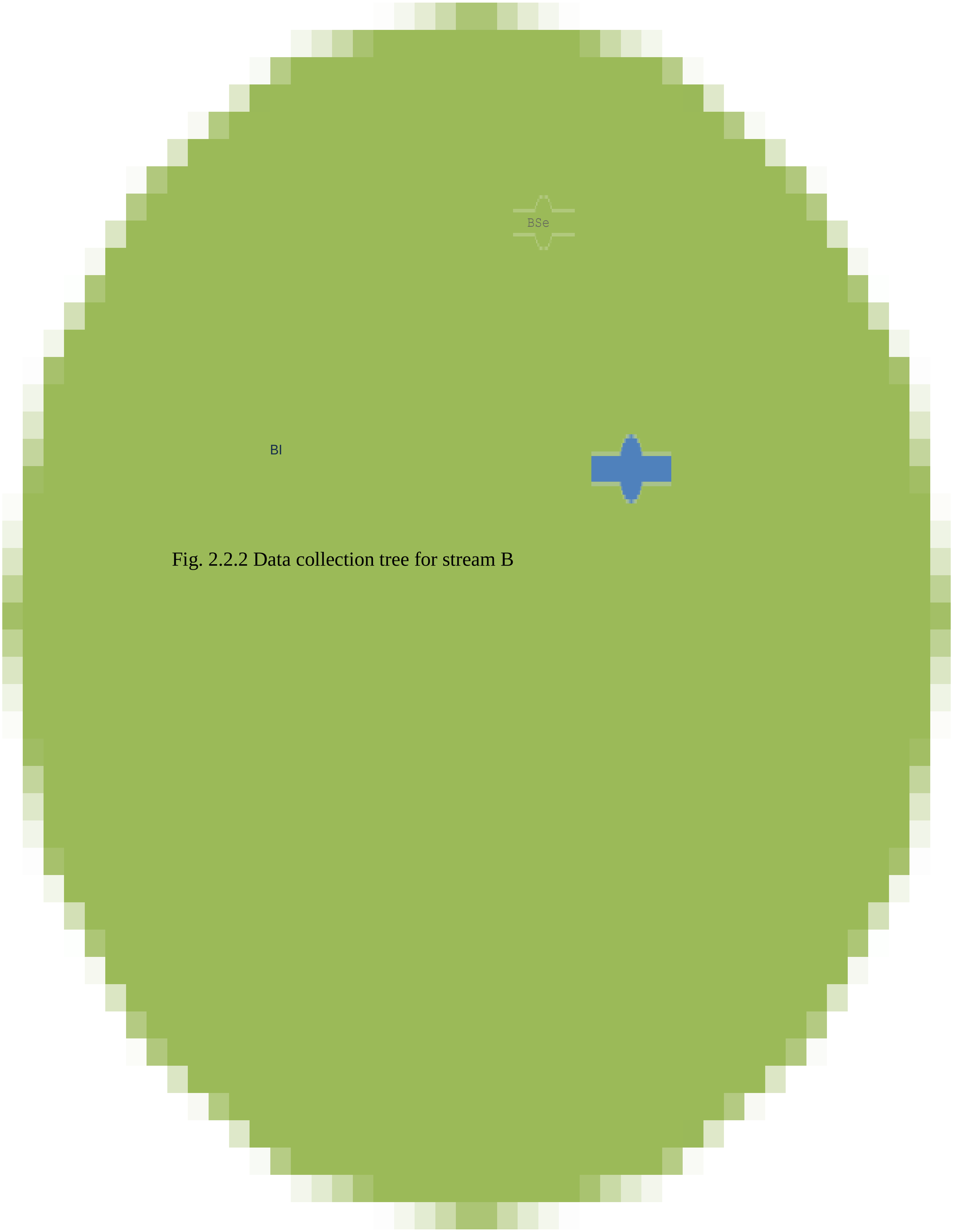


Fig. 2.2.2 Data collection tree for stream B

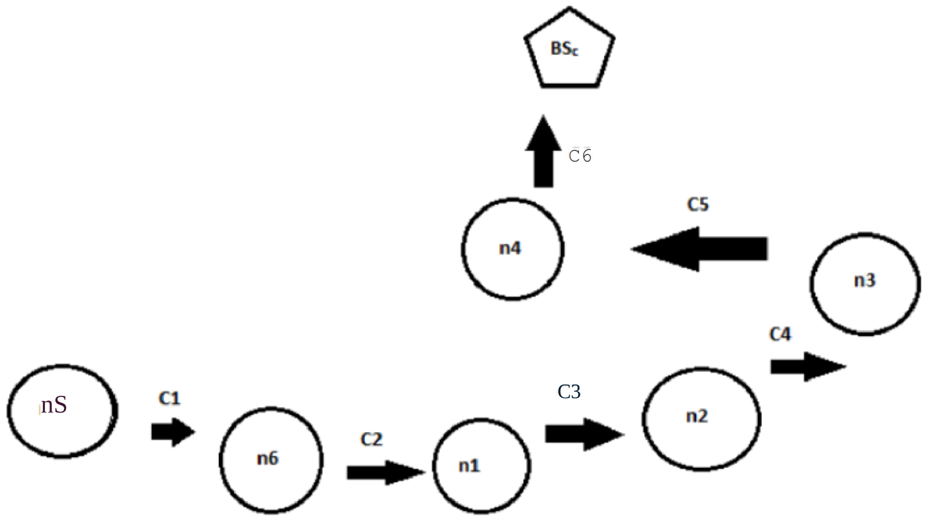


Fig 2.2.3 Data collection Tree for Stream C

§-ring:

it is the type of ring structure which is formed when the following condition satisfies:

IN | >3s

Where lNl is the total number of nodes and s is the number of data streams . In this the communication is N2N and N2base-station.

Let us consider there we IN I node give as (ni r›,ni,. .. . .,n N›I . In the interval where T<ti node n i in the s' h data gathering process data send to node n« and the ns will involve in node to base station communication and this will form a ring structure and this structure is called */J-ring* structure. Where c i ,c›,ci are define below

ci = (l + mod (3(s — l) +2*(T — l), IN I)),

c‹ = (l + mod (3(s — l) +2*(T- l)+ l , IN I)),

cs = (I + mud (3(S — 1) + 2*(T — 1) + 2; IN I));

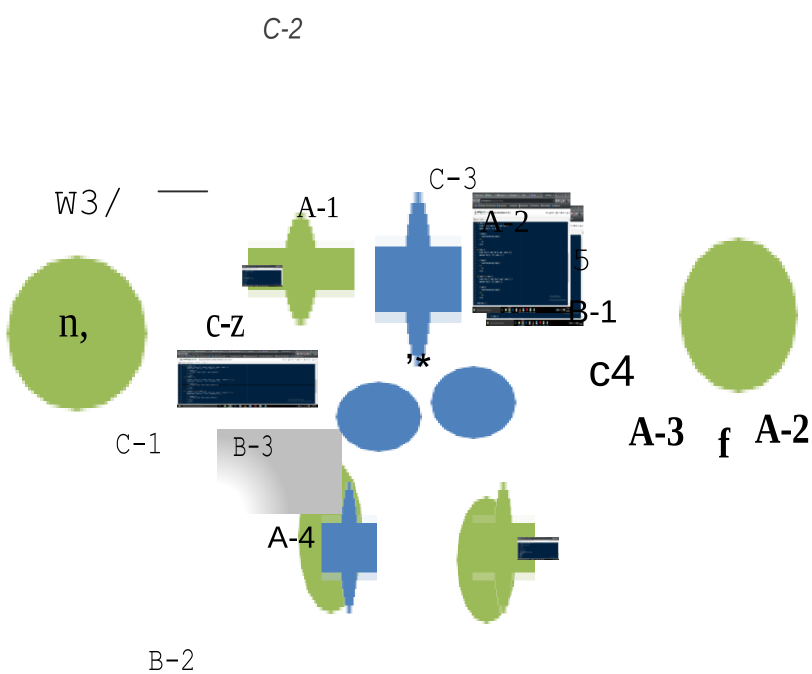


Fig 2.3 *J-ring* when lNl=9 and the streams s = 3

Consider an example of §-ring is as shown in fig where total number of nodes IN I = 9 and number of data stream (s) = 3. Therefore , mq„=3. This shows that for ti time- slot maximum nodes used by data stream nre 3.

Let us assume that the name of streams is (A, B, C} and these streams ore divided in to 5 parts.

for l" time-slot A i uses node ni and nz which is node to node communication and n«› is se nding data to base station which is node to base station communication similarly B i use node re and ns for node to g{xle communication and na to base station and C i uses ni and ns for nude to node communication and n‹, for nude to base station communication. In the same manner for '"‘ time-slot Az uses node na and n‹ for node to node and nz for node to base station whereas Bz use node n‹„ n7 and ns and Cz uses n›,ni and ns. This node-to node and node to base station communication is there for four-time slot and finally at the fifth time-slot tire is only node to base communication where data is to be pmcessed using the DADCNS and it will last for t, time-slots and aggre gated at the base -station at the end.

T = t i + tz = 4 + l = 5

Data collection free tor Q-ring :

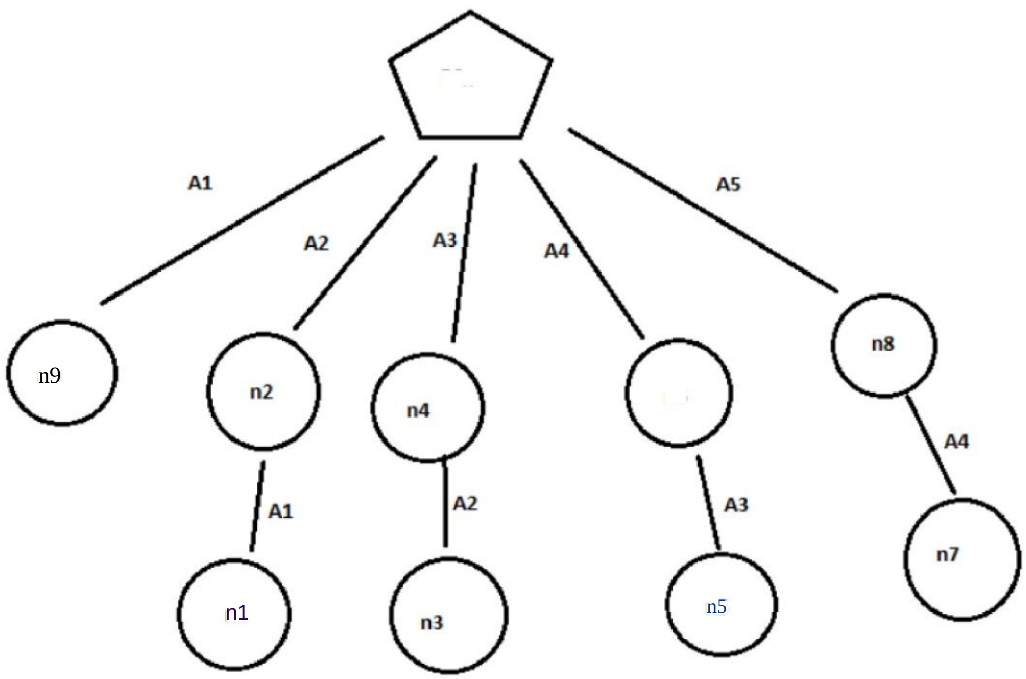


Fig 2.4.1 Data collection tree for stream

BSa

Fig 2.4.2 Data collection tree for stream

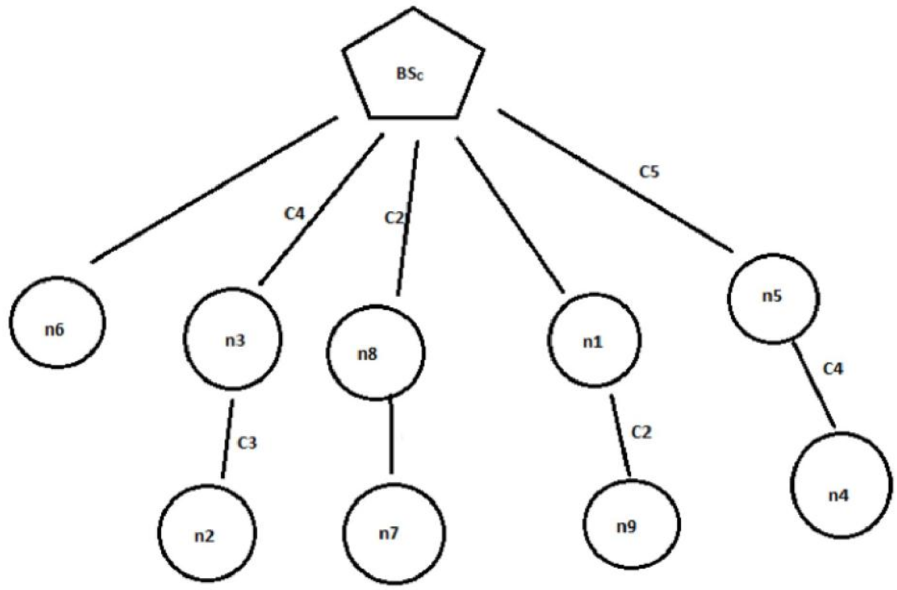


Fig 2.4.3 Data collection tree for stream

MULTIPLE RINGS:

no. of 'n' rings are produced. Every - ring will be first allocated with 2.i *no. of* nodes. Remaining 1 N 1 - n (2s) nodes are then allotted to the n rings sequentially. Difference in o-ring size will be less than I between two nbitrnry rings. Two nodes are used by the data stream of every n-ring. At time Ti + I remaining nodes will be ready to submit the information. Data is retrieved easily among these nodes using Tz time slots.

f ‹i ›‹' 2 — »,, ‹, /› ‹›‹/‹/ ‹iii‹/ > = .

In this one § ring and n' = (m<,, — 3)/2 no. of o-rings are produced. At the beginning 2s nodes are allocated for each n ring whereas 3k nodes are allocated for every § ring.

The remaining I N 1 - 3sss — n' (2sss) nodes are allotted to the § ring until 1 N 1 = 2t i + I . The remaining nodes we allocated to the e ring sequentially. § rings nre filled up before the o rings because § rings reduces the data collection time for same no. of nodes as it takes lesser time. Furthermore, all of its

Node-to-Node communications are accomplished in the I

" t I time-slots, as the highest § ring size is restricted to 2t i

+ 1 .

For 1 Ns 1 = 2ti I , the network m+; nodes in first T I slots,

while remaining nodes will take T2 time-slots.

the two algorithms.

PERFORMANCE ANALYSIS

The exact distinction in execution regarding schedule openings taken by the framework to gather information from the tree and afterward transmitting it to the Base Stations can be figured simply in the wake of deciding precise and exact estimations of time taken for the new pmposed al gorithm to transmit and share information.

Be that as it may, as plainly referenced in the first algorithm, the time taken by a § ring to gather information and transmit it to BS is not as much as time taken by a o ring.Using this as the basis, we can arrive at an estimated result.

The original algorithm , in case of multiple rings, aims to genernte as many number of o rings as possible under the conditions of N and k, and in any given case will produce at most one § ring.

The new proposed algorithm heavily differs from the original one as it is exactly opposite. In any given case, it aims to produce maximum number of § rings for a given value of N and k, while forming at most one o ring if necessary.

Since the new proposed algorithm produces far more number of § rings and less number of o rings, hence it is self-explanatory that the new proposed algorithm will be much more efficient as a § ring is more efficient than an o ring .

But the exact difference between the two algorithms will be clear once the precise time slots required to collect data are computed.

The execution of the proposed system structure is additionally examined utilizing PQ recreations. In the recreations, the term of an information gathering prr›cess T with k simultaneous streams is utilized as the execution marker. T is communicated as the all out number of timeslots required by the BS of various streams to gather information from every one of the hubs in the system. In every reenactment, a system with IoT hubs is considered. In the tests, execution of the first the original al gorithm wJl be utilized as a source of perspective. So as to assess the impact of and k to the execution of systems with various system structures, is fluctuated from 0 to 300 with a stage size of 15 while k is shifted from 2 to 10. Results are appeared in the figures beneath.

Comparative graphs for different values for N and k

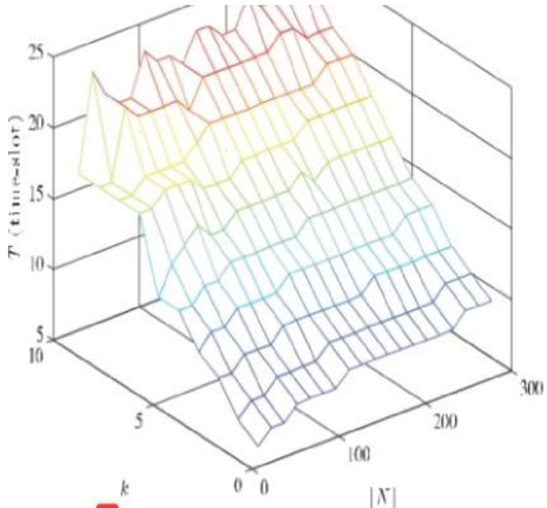


Fig. 3. Data collection durations of the proposed data collection tree in networks with *IN I* nodes and *k* concurrent data streams

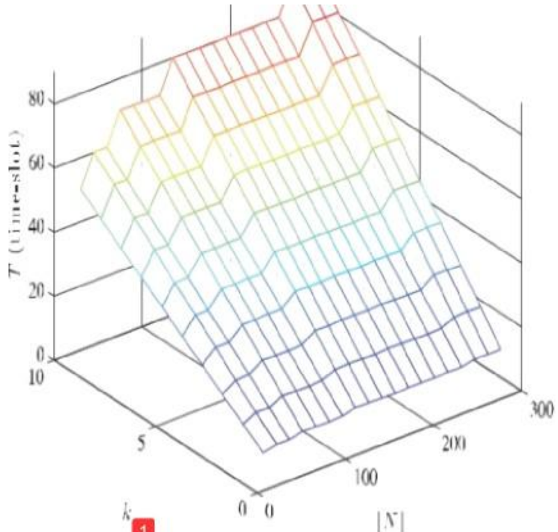


Fig. 4. Data collection durations of the DADCNS in networks data with *IN I* nodes and *k* data concurrent data streams.

The above graphs represent the time taken for initial accumulation of data (t I) for the original as well as the proposed al gorithms and it shows conclusively that for the variety of values of N and k taken and the cases considered, keeping all other factors constant, the proposed al gorithm performs better than the original al gorithm and saves upto 30°/o time in the data aggre gation process, which for any WSN is a huge efficiency boost. The graph for time of the proposed algorithm flat lines after a time for any number of nodes , keeping the value of k as the same and this shows the overall efficiency of the al gorithm and its ability to handle high-density networks

"I“he time taken by the two al gorithins to acstimulate the data can be compared more clearly by fixing the aliie of k and then calculating the time taken as a function of N .

"I he time taken (t I) is plotted against the number of nodes (N) for 3 different values of k, i .e k—4, k=6 & k=9.

Time comparison of original and proposed algorithms for different values of N keeping k constant

K=4

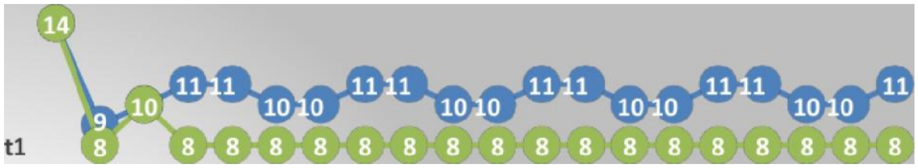
t1

15 30 45 60 75 90 105120135150165180195210225240255270285300

N

Original Algorithm   Proposed Algorithm

K=6

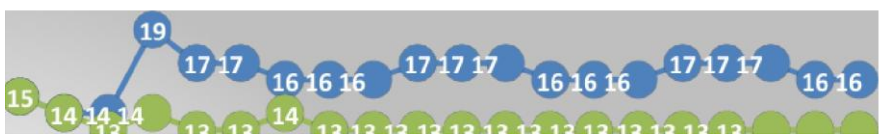


15 30 45 60 7S 90 105120 1351501651801952102252402552702853OO
N

Original Algorithm Pro posed Algorithm

Fig 27 (b) K=6

K=9



t1

15 30 ^S 60 75 90 1051201351501651801952102252402552702853OO
N

Original Algorithm Proposed Algorithm

Fig 27 (c) K = 9

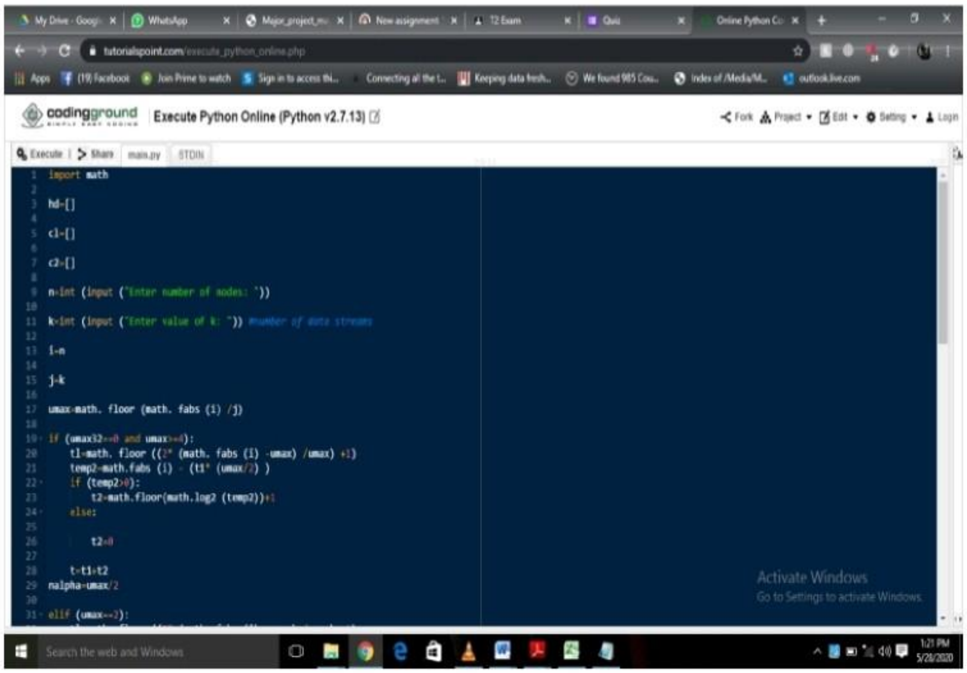
Conclusion

Hence the original algorithm, that has established a new concept to efficiently collect data from IOT networks using special kinds of rings, has been modified and working on the similar principal a new set of procedure is proposed that differs in the structure and distribution of these special rings to further improve the time requirement of the process .

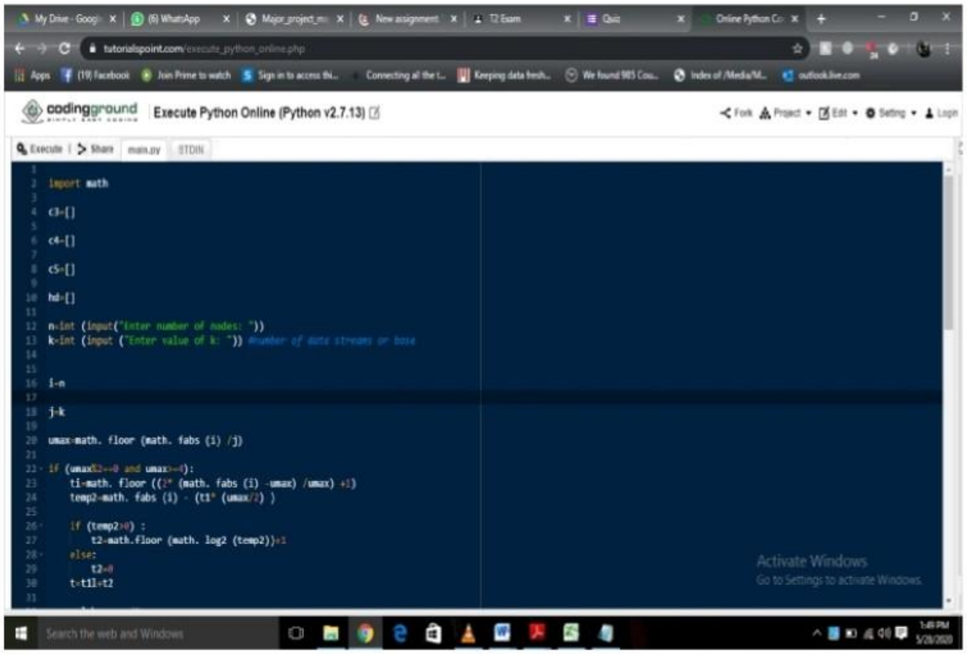
Future Scope:

It has been established that the new proposed al gorithm is more efficient than the original one based on the basic principles that are formulated to design these algorithms. Furthermore, some work may be done to improve the time required to collect aggre gated data from all nodes and send it across to the base station.

Code for Calculating Time Slots and Data Streams Alpha Ring



Beta Ring



codingground
Execute Python Online (Python v2.7.13)
Execute
Share
main.py
STDIN
import math
c3=[]
c4=[]
c5=[]
hd=[]
n=int (input("Enter number of nodes: "))
k=int (input ("Enter value of k: "))
i=n
j=k
umax=math. floor (math. fabs (i) /j)
temp2=math. fabs (i) - (t1* (umax/2))
t2=math.floor (math. log2 (temp2))+1
else:
t2=0
t=t1l+t2
Activate Windows
Go to Settings to activate Windows.
Search the web and Windows

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