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## Patent Search

Invention Title	Integrating IoT, A3C learning, residual recurrent neural networks, and dynamic scheduling for stochastic edge-cloud computing environmen
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Field Of Invention	COMPUTER SCIENCE
Classification (IPC)	G06N0003040000, H04L0029080000, G06F0009500000, G06N0003080000, G05B0015020000

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#### Abstract:

[05] With the introduction of Internet of Things (IoT) applications, a new computing paradigm known as "fog computing" has emerged, enabling the efficient and seamless utilisation of resources from mobile-edge devices and the cloud. Due to limited resource capacity, mobility concerns in the Internet of Things (IoT), resource heterogeneity, network hierarchy, and random behaviour, it is challenging to schedule application tasks efficiently. Utilization of heuristics and reinforcement Learning-based techniques is ineffective because they cannot be applied to new problems and cannot adjust rapidly. They can only be utilised in central locations and cannot take advantage of seasonal workload fluctuations. However, Asynchronous Actor Benefit Critical learning and the Residual Recurrent Neural Network are renowned for their rapid parameter adjustments, and they both perform well in environments with limited data and a high pace of change. Consequently, we recommend an A3C-based real-time scheduler for Cloud environments where things can go wrong. Using this scheduler, multiple agents can simultaneously engage in distributed learning. We utilise the R2N2 architecture, which permits us to monitor a vast array of host and job parameters as well as temporal patterns. This facilitates improved scheduling decisions. This model is adaptive, and its hyper-parameters can be modified to better suit the current task. Using sensitivity analysis to demonstrate why we selected the hyper-parameters that we did. Experiment results on real-world data sets indicate that cutting-edge algorithms can be enhanced by 14%, 7.74%, 31.9%, and 4.64 %, respectively, in terms of energy consumption, reaction time, SLA, and operation cost. Accompanied Drawing [FIG. 1] [FIG. 2][FIG. 3]

#### Complete Specification

Description: The present invention relates to stochastic edge-cloud computing environments.

#### [02] BACKGROUND OF THE INVENTION

As a result of these developments, there is a substantial increase in streaming data and the emergence of new forms of computational workloads. Consequently, the Internet of Things' underlying computer infrastructure must address issues such as heterogeneity, changing availability and performance, and scalability. Large-scale Internet of Things systems can be developed using highly concurrent event-driven architectures due to their concurrency, scheduling, and service separation and isolation capabilities. As the importance of servers grew, this technology was developed as an alternative to traditional computing. New tiered cloud architectures that include Internet of Things devices with limited capabilities. Similar to the public cloud, the "edge cloud" is a service-hosting technology located at the network's edge. This allows IoT deployments to maximise resource utilisation, reduce the requirement for wide-area bandwidth, shorten response times, make applications more fault-tolerant, and enhance security. To maximise the benefits of the Internet of Things (IoT), edge cloud computing, and private and public clouds, a dependable scheduling system is essential. In this thesis, we present our efforts to develop an event-driven, geo-distributed, intelligent scheduling system for heterogeneous IoT devices and applications running at the network's edge. We are studying how a serverless computing platform could be used to simultaneously enhance many machine learning applications. We also study how serverless computing, which can be used for both private and public cloud deployments, can be utilised for intelligent scheduling at the edge and in the cloud. People are experimenting with voltage and frequency changes to prevent computers from overheating in hazardous environments. This strategy can be utilised to control the temperature of edge cloud resources. Our results contribute to the growing corpus of research on offloading computing for CPSs. Consequently, the objective of this study is to identify ways for matching workloads with currently available resources in the public cloud, private cloud, and edge cloud.

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### Application Details

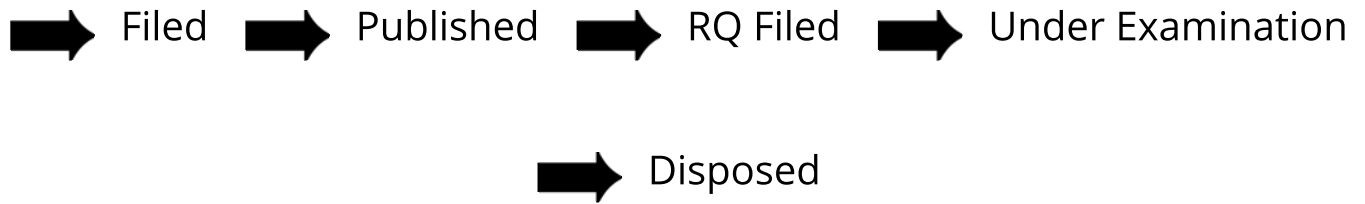
APPLICATION NUMBER	202241055255
APPLICATION TYPE	ORDINARY APPLICATION
DATE OF FILING	27/09/2022
APPLICANT NAME	1 . Dr. K. Arul Marie Joycee 2 . Mr. Jamnesh patel 3 . Dr. Amit Kumar bhati 4 . Addagatla Prashanth 5 . Dr. Neeraj Kumar Sharma 6 . C.Geetha 7 . Mr. Y. M. Mahaboobjohn 8 . V.Muthu sowniya 9 . S P Santhoshkumar 10 . Ramasamy Subramaniyam 11 . Dr. Harikumar Pallathadka
TITLE OF INVENTION	Integrating IoT, A3C learning, residual recurrent neural networks, and dynamic scheduling for stochastic edge-cloud computing environments
FIELD OF INVENTION	COMPUTER SCIENCE
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ADDITIONAL-EMAIL (As Per Record)	
E-MAIL (UPDATED Online)	
PRIORITY DATE	
REQUEST FOR EXAMINATION DATE	--
PUBLICATION DATE (U/S 11A)	14/10/2022

Application Status

APPLICATION STATUS

**Awaiting Request for Examination**

[View Documents](#)



In case of any discrepancy in status, kindly contact [ipe-helpdesk@nic.in](mailto:ipe-helpdesk@nic.in)

<b>FORM 1</b> THE PATENTS ACT 1970 (39 of 1970) and THE PATENTS RULES, 2003 <b>APPLICATION FOR GRANT OF PATENT</b> (See section 7, 54 and 135 and sub-rule (1) of rule 20)				(FOR OFFICE USE ONLY)	
				Application No.	
				Filing date:	
				Amount of Fee paid:	
				CBR No:	
				Signature:	
<b>1. APPLICANT'S REFERENCE / IDENTIFICATION NO. (AS ALLOTTED BY OFFICE)</b>					
<b>2. TYPE OF APPLICATION [Please tick (✓) at the appropriate category]</b>					
Ordinary (✓)		Convention ( )		PCT-NP ( )	
Divisional ( )	Patent of Addition ( )	Divisional ( )	Patent of Addition ( )	Divisional ( )	Patent of Addition ( )
<b>3A. APPLICANT(S)</b>					
Name in Full		Nationality	Country of Residence	Address of the Applicant	
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3. Dr. Amit Kumar bhati		INDIAN	India	Associate Professor, GN Group of Institutes, Greater Noida,	

			Pin: 201310 Uttar Pradesh, India
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7. Mr. Y. M. Mahaboobjohn	INDIAN	India	Assistant Professor, Mahendra College of Engineering Minnampalli, Salem, Pin: 636106 Tamilnadu, India
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9. S P Santhoshkumar	INDIAN	India	Assistant Professor, Department of Information Technology, Rathinam technical Campus, Rathinam Techzone Campus, Pollachi Main Road, Eachanari, Coimbatore,

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10. Ramasamy Subramaniyam	INDIAN	India	Assistant Professor, Madanapalle Institute of Technology and Science, Madanapalle, Pin:517325 Chittoor, Andra Pradesh, India
11. Dr. Harikumar Pallathadka	INDIAN	India	Director and Professor, Manipur International University, Ghari, Imphal, Imphal West, Pin: 795140 Manipur, India
Natural Person (✓)	Other than Natural Person		
	Small Entity ( )	Startup ( )	Others ( )
<b>4. INVENTOR(S) [Please tick (✓) at the appropriate category]</b>			
Are all the inventor(s) same as the applicant(s) named above?	Yes (✓)		No ( )
<b>If “No”, furnish the details of the inventor(s)</b>			
Name in Full	Nationality	Country of Residence	Address of the Inventor
Same as Applicant			
<b>5. TITLE OF THE INVENTION</b>			
“Integrating IoT, A3C learning, residual recurrent neural networks, and dynamic scheduling for stochastic edge-cloud computing environments”			
<b>6. AUTHORISED REGISTERED PATENT AGENT(S)</b>		IN/PA No.	
		Name	
		Mobile No.	
<b>7. ADDRESS FOR SERVICE OF APPLICANT IN INDIA</b>		Name	Dr. K. Arul Marie Joycee
		Postal Address	Head of the Department of Computer Science A.D.M. College for Women (Autonomous), No.1 Cooks Road, Velippalayam, Nagapattinam. Pincode: 611001 Tamilnadu India



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**8. IN CASE OF APPLICATION CLAIMING PRIORITY OF APPLICATION FILED IN-CONVENTION**

**COUNTRY, PARTICULARS OF CONVENTION APPLICATION**

Country	Application Number	Filing date	Name of the applicant	Title of the invention	IPC (as classified in the convention country)

**9. IN CASE OF PCT NATIONAL PHASE APPLICATION, PARTICULARS OF INTERNATIONAL APPLICATION FILED UNDER PATENT CO-OPERATION TREATY (PCT)**

International application number	International filing date

**10. IN CASE OF DIVISIONAL APPLICATION FILED UNDER SECTION 16, PARTICULARS OF ORIGINAL (FIRST) APPLICATION**

Original (first) application No.	Date of filing of original (first) application

**11. IN CASE OF PATENT OF ADDITION FILED UNDER SECTION 54, PARTICULARS OF MAIN APPLICATION OR PATENT**

Main application/patent No.	Date of filing of main application


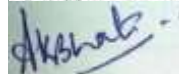

**12. DECLARATIONS**

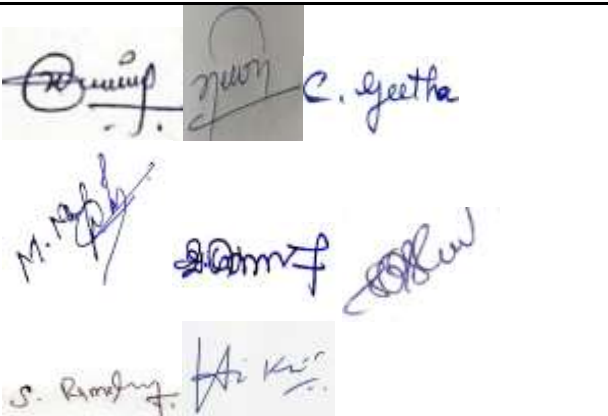
**(i) Declaration by the inventor(s)**

(In case the applicant is an assignee: the inventor(s) may sign herein below or the applicant may upload the assignment or enclose the assignment with this application for patent or send the assignment by post/electronic transmission duly authenticated within the prescribed period).

I/We, the above named inventor(s) is/are the true & first inventor(s) for this Invention and declare that the applicant(s) herein is/are my/our assignee or legal representative.

(a) Date 27/09/2022

(b) Name	(c) Signature
1. Dr. K. Arul Marie Joycee	  
2. Mr. Jamnesh patel	
3. Dr. Amit Kumar bhati	
4. Addagatla Prashanth	
5. Dr. Neeraj Kumar Sharma	
6. C.Geetha	
7. Mr. Y. M. Mahaboobjohn	
8. V.Muthu sowniya	

<p>9. S P Santhoshkumar 10. Ramasamy Subramaniam 11. Dr. Harikumar Pallathadka</p>		
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**(ii) Declaration by the applicant(s) in the convention country**

~~(In case the applicant in India is different than the applicant in the convention country: the applicant in the convention country may sign herein below or applicant in India may upload the assignment from the applicant in the convention country or enclose the said assignment with this application for patent or send the assignment by post/electronic transmission duly authenticated within the prescribed period)~~

~~I/We, the applicant(s) in the convention country declare that the applicant(s) herein is/are my/our assignee or legal representative.~~

~~(a) Date~~

~~(b) Signature(s)~~

~~(c) Name(s) of the signatory~~

**(iii) Declaration by the applicant(s)**

I/We the applicant(s) hereby declare(s) that: -

- ~~I am/We are in possession of the above-mentioned invention.~~
- ~~The provisional/complete specification relating to the invention is filed with this application.~~
- ~~The invention as disclosed in the specification uses the biological material from India and the necessary permission from the competent authority shall be submitted by me/us before the grant of patent to me/us.~~
- ~~There is no lawful ground of objection(s) to the grant of the Patent to me/us.~~
- ~~I am/we are the true & first inventor(s).~~
- ~~I am/we are the assignee or legal representative of true & first inventor(s).~~
- ~~The application or each of the applications, particulars of which are given in Paragraph-8, was the first application in convention country/countries in respect of my/our invention(s).~~
- ~~I/We claim the priority from the above mentioned application(s) filed in convention country/countries and state that no application for protection in respect of the invention had been made in a convention country before that~~

date by me/us or by any person from which I/We derive the title.

- My/our application in India is based on international application under Patent Cooperation Treaty (PCT) as mentioned in Paragraph 9.
- The application is divided out of my /our application particulars of which is given in Paragraph 10 and pray that this application may be treated as deemed to have been filed on DD/MM/YYYY under section 16 of the Act.
- The said invention is an improvement in or modification of the invention particulars of which are given in Paragraph 11.

### 13. FOLLOWING ARE THE ATTACHMENTS WITH THE APPLICATION

(a) Form 2

Item	Details	Fee	Remarks
Complete/ Provisional specification)#	No. of pages : 16		
No. of Claim(s)	No. of claims : 08 No. of pages: 01		
Abstract	No. of pages: 01		
No. of Drawing(s)	No. of drawings: 03 No. of pages: 03		

# In case of a complete specification, if the applicant desires to adopt the drawings filed with his provisional specification as the drawings or part of the drawings for the complete specification under rule 13(4), the number of such pages filed with the provisional specification are required to be mentioned here.

- (b) Complete specification (in conformation with the international application)/as amended before the International Preliminary Examination Authority (IPEA), as applicable (2copies).
- (c) Sequence listing in electronic form
- (d) Drawings (in conformation with the international application)/as amended before the International Preliminary Examination Authority (IPEA), as applicable (2copies).
- (e) Priority document(s) or a request to retrieve the priority document(s) from DAS (Digital Access Service) if the applicant had already requested the office of first filing to make the priority document(s) available to DAS.
- (f) Translation of priority document/Specification/International Search Report/International Preliminary Report on Patentability.
- (g) Statement and Undertaking on Form 3
- (h) Declaration of Inventorship on Form 5
- (i) Power of Authority
- (j) **Total fee ₹.....in Cash/ Banker's Cheque /Bank Draft bearing No.....  
Date on..... Bank.**

I/We hereby declare that to the best of my/our knowledge, information and belief the

fact and matters slated herein are correct and I/We request that a patent may be granted to me/us for the said invention.

**Dated this 27<sup>th</sup> day of September, 2022**

**Signature:** 

Name: Dr. K. Arul Marie Joycee et al.

To,  
The Controller of Patents  
The Patent Office, at Chennai

Note: -

- \* Repeat boxes in case of more than one entry.
- \* To be signed by the applicant(s) or by authorized registered patent agent otherwise where mentioned.
- \* Tick (/) / cross (x) whichever is applicable / not applicable in declaration in paragraph-12.
- \* Name of the inventor and applicant should be given in full, family name in the beginning.
- \* Strike out the portion which is / are not applicable.
- \* For fee: See First Schedule";