Ministryof Higher Education and
Scientific Research

University of Diyala
College of Science Department
of Computer Science

An Efficient Health System Using ICPSO

A Thesis
Submitted to the Department of Computer Science\ College of Sciences\ University of Diyala in a Partial Fulfillment of the Requirements for the Degree of Master in Computer Science

By

Reem Majid Shuker

Supervised By

Prof. Dr. Dhahir Abdulhade Abdulah

2019A.D **Iraq** **1441A.H**

ويسألونك عن الروح قل الروح من ربي
وما أوتيتم من العلم إلا قليل ﴿48﴾

سورة ألسراء آلية)48-48(

Dedication

To …
Our Prophet Mohammed
Peace
be Upon Him (PBH)
My dear parents
My sisters and my brothers
My friends
I produce this work with all

Reem Majid

Acknowledgment

First of all, praise is to Allah, the lord of the whole creation, on all the blessing was the help in achieving this research to its end. I wish to express my thanks to my supervisors, Prof.Dr. ***Dhahir Abdulhade Abdulah*** *for supervising this research and for the generosity, patience and continuous guidance throughout the work. It has been my good fortune to have the advice and guidance from them. My thanks to the academic and administrative staff at the Department of the computer sciences.*

I would like to thank my family who have supported me throughout the past two years and encouraging me to further my studies and help to complete this master project.

Reem Majid

Examination Committee Certification

We certify that we have read the thesis entitled ***"An Efficient Health System Using ICPSO"*** *and as examination committee, examined the student* ***"Reem Majid Shuker "*** *in the thesis content and that in our opinion, it is adequate as fulfill the requirement for the Degree of Master in Computer Science at the Computer Science Department, University of Diyala.*

Signature:
Name: Prof. Dr. Ziyad Tariq Mustafa (Chairman)
Date: / / 2020

Signature:
Name: Prof. Naji Mutar Suhaib (Member)
Date: / / 2020

Signature:
Name: Asst. Prof. Dr. Omer Younis Abd Alhameed (Member)
Date: / / 2020

Signature:
Name: Prof. Dr. Dhahir Abdulhade Abdulah (Supervisor)
Date: / / 2020

Approved by the Dean of College of Science /University of Diyala

Signature:
Name: Prof. Dr.Tahseen Hussein Mubarak
Date: / / 2020

Head of Computer Science Department

Supervisor's Certification

I certify that this thesis entitled **"An Efficient Health System Using ICPSO"** *was prepared under my supervision at Department of Computer Science\ College of Sciences\University of Diyala in a partial fulfillment of the requirements for the degree of Master of Science in Computer Science.*

Signature:
Name : Prof. Dr. Dhahir Abdulhade Abdulah
Date: / / 2020

Approved by at University of Diyala , Faculty of Science Department of Computer Science

Signature:
Name: Asst. Prof. Dr. Taha Mohammad Hassan
Date: / / 2020

(Head of Computer Science Department)

Scientific Certification

I certify that this *thesis* entitled "***An Efficient Health System Using ICPSO ”*** **presented by "*Reem Majid Shuker*"** has been evaluated scientifically, therefore, it is suitable for debate by examining committee.

Signature:

Name: Prof. Dr. Assa'd Tallb Hassun

Date: / / 2020

Linguistic Certification

*This is to certify that this thesis entitled "**An Efficient Health System Using ICPSO "** was prepared under my linguistic supervision. It was amended to meet the style of English language.*

Signature:

Name: Laith Majied Abd Latif

Date: / / 2020

Contents

List of Figures

List of Tables

List of Abbreviations

Abbreviations	Meaning
HCS	Health Care System
IoT	Internet of Things
MBAN	Medical Body Area Network
WSN	Wireless Area Network
BAN	Body Area Network
BSNs	Body Sensor Networks
HTTP	Hypertext Transfer Protocol
COAP	Constrained Application Protocol
MQTT	Message Queue Telemetry Transport
VM	Virtual Machine
PSO	Particle Swarm Optimization
IPSO	Integer PSO
BPSO	Binary PSO
VPSO	Veeramachaneni PSO

PPSO	Pugh PSO
AMPSO	Angle Modulated PSO
ICPSO	Integer and Categorical PSO
ICU	Intensive care unit
AT	Arrival Time
CT	Completion Time
TT	Turnaround Time
ATT	Average Turnaround Time
WT	Waiting Time
AWT	Average Waiting Time
BT	Burst Time
CPU(U)	CPU Utilization
ACPU(U)	Average CPU Utilization

List of Algorithms

Abstract

Health care systems based Internet of Things (IoT) and cloud computing service play a significant role in Information and Communication Technologies and has a contribution in the development of medical information systems and monitoring patient health care.

The goal of system the proposed to find best server (VM) when exist IoT network that be large data from MBAN develop the healthcare methods performance by decreasing the MBAN user cost time of implementation storage large data of patients optimization the essential ,offering a actual time so that time and cost are saved in healthcare system. Furthermore, it aids the MBAN to decrease their time of waiting, time of turnaround for medical needs on the cloud environment, lessen CPU waste utilization of VMs, and exploit resources utilization.

The proposed system architecture cloud-IoT contains of four key components: devices of the (MBAN user), IoT Router, broker of cloud and server of cloud HCS . To enhance the (VMs) selection by , the proposed algorithm utilizes localized joint probabilities between pairs of state variables to represent dependencies explicitly called (ICPSO) algorithm used to construct a suggested system.

A compute the cost time speed of (MBAN user) needs, the suggested fitness of function be present a composited of seven essential attributes that utilization of CPU, turnaround time and time of waiting, execution speed time, physical no latency, physical latency, cost time and three secondary arrival times, completion time ,barst time.

The proposed system is verified with previous works to assess its efficiency. The simulation results appearance that the proposed system evaluated performance efficiently of the proposed algorithm

(70.713%) when exist physical network latency, (50.704%) when no exist physical network latency. Average time of CPU is (2 milliseconds). Improvement of the suggested system over the Previous study is (28.44%) when no network latency is considered and (31.77%)when the physical network latency parameter is considered.

Chapter One

General Introduction

Chapter One

General Introduction

1.1 Introduction

Health system (HS) are considered of the most medical fields of interest to the world at the present time. The optimal use of HS saves many people from death. Stakeholders of the HS such as the patients and the doctors use traditional methods to retrieve patients data to find out the patients' health condition in a long time, but using modern methods such as cloud computing can retrieve patients data in less time and less cost. The medical researches concentrate on human health in the areas of health monitoring, health data archiving, the doctor patient interaction recent years, anticipations about keeping patient data and health services become difficult operation. [1].

A large set of 'IoT' is currently being used in healthcare, which results in a large volume of data. To analyze, store, and pre-process the large variety, volume, and veracity of data, cloud servers are used worldwide. The cloud is currently the only available feasible solution for communications among healthcare 'IoT' [2] .

Cloud computing ease the burden of healthcare 'IoT' devices by removing battery draining computational tasks. The cloud is the only place for the analysis, filtering, pre-processing, and aggregation of data generated from healthcare 'IoT' devices. However, the cloud has its limitations concerning healthcare 'IoT'.

Owing to the increasing transmission and the determination of these high volumes of data, the reaction time in cloud Computing is increasing as well. An upsurge in reaction time results in a higher service latency to end users [3].

For large data transmissions, more data are transmitted over a network, hence the higher probability of an error occurring and scheduling task. Packet loss and transmission latency are proportional to the amount of data transmitted from 'IoT' to cloud servers. This causes a poor quality of service (QoS) to end-users [4]. In many time-critical applications of the IoT, cloud-scale processing and storage are not required. Extreme time-bounded selections should be made closer to IoT devices. The healthcare infrastructure requires real-time data for time-sensitive applications. The critical requirements for healthcare 'IoT' are minimum latency and network bandwidth conservation [5]. The cloud and end-devices are connected via routers and gateways. Therefore, a large number of routers are placed between healthcare 'IoT' and the cloud. These routers incur computation delays. The larger the distance, the larger is the number of routers used between the source and destination. Data travel a long route from end-devices to a cloud server and consume a high bandwidth [6].

Cloud computing can perform an important role in containing healthcare costs, optimising resources and ushering in a new period of innovations. Current orientation target towards accessing data anytime, anywhere, which can be accomplished when moving healthcare data to the cloud computing and scheduling task to server using heuristic algorithm Integer and Categorical Particle Swarm Optimization (ICPSO) is a new discrete particle swarm optimization algorithm that is designed to handle both integer and categorical state variables [7].

The objective of the scheduling problem is to minimize the total cost of each task during the process in the cloud computing network generally, the thesis enhances user application and minimizes the cost execution time in order to give vast benefits to the both patient and workers medical.

2.1 Related Work

This section reviews some of previous studies and explains the different techniques that are used for developing and enhance scheduling and performance of VMs in a cloud-IoT environment for health system as follow:

1- S.D.Yu and et al (2014)[8]: The propose a distributed parallel genetic algorithm (DPGA) of placement strategy for virtual machines deployment on cloud platform. It executes the genetic algorithm parallel and distributed on several selected physical hosts in the first stage. Ten it continues to execute the genetic algorithm of the second stage with solutions obtained from the frst stage as the initial population. the solution calculated by the genetic algorithm of the second stage is the optimal one of the proposed approach. The experimental results show that the proposed placement strategy of VM deployment can ensure QoS for users and it is more effective and more energy efficient than other placement strategies on the cloud platform.

2- A.T. Parmar and et al. (2015)[9]: The presented an approach to find optimal VM allocation in cloud environment based on FCFS algorithm. This study tries to find optimal VM allocation to reduce energy consumption, reduce time from users' tasks and facilitate task scheduling.

FCFS algorithm may discover optimal VM allocation in cloud computing environment. But, it needs to improve task scheduling.

3-M.M . Rathore, et al. (2016)[10]: They proposed IoT-based Real-time Medical Emergency Response System by exploiting Big Data analytics. The proposed system involves a different aspect of hospitals, emergency services, first aid, and police stations. The view to developing continuous follow up and monitoring individual vital signs anytime anywhere anyhow, a flexible system was designed based on Intelligent Building that analyzes the data received from various medical sensors attached to various persons. The system was implemented using hadoop ecosystem and Spark as a real-time processing tool. The performance of the system was tested on a hadoop. The evaluation showed that the performance of the proposed network architecture fulfills the required needs of a city or nation, whether the input data are real time or offline, while taking actions in real time.

4-S.D. Ebrahim and et al. (2016) [11]: The proposed to obtain the optimal VM placement based on modified PSO algorithm. This study tries to find the best VM placement to give the quality of services of users' tasks and minimize energy consumption. This proposed method can find the optimal VM placement by a modified PSO algorithm to save power consumption and facilitate task scheduling.

5- J. Hanen and et al. (2016) [12]: The proposed system to help patients to treat heart rate signal remotely based on medical cloud computing system (MCCS). MCCS is applied to Google's Android operating system and CloudSim for solution traditional problem in analysis heart rate .

MCCS may find the better solution for analysis heart rate signal on mobile cloud computing.

6- S. Luo and el al (2016)[13]: The proposed system remote monitoring cloud platform of healthcare information (RMCPHI) was established firstly. Then the RMCPHI architecture was analyzed. Finally, an efficient PSOSAA algorithm was proposed for the medical monitoring and managing application of cloud computing. Simulation results showed the proposed scheme can improve the efficiency about 40%.

7- A. Abdelaziz, and et al. (2017)[14]: This paper proposes a new intelligent architecture for HCS. also, this paper proposes three intelligent algorithms are a genetic algorithm (GA), particle swarm optimization (PSO) and parallel particle swarm optimization (PPSO) to find optimal chosen of VMs in a cloud environment. For that, this paper uses MATLAB tool to find optimal intelligent algorithm and cloudsim to find optimal chosen of VMs in a cloud environment. The results proved that PPSO algorithm is better than GA and PSO algorithms.

8- M. Elhoseny and et al. (2018)[15]: This proposes a new model to optimize virtual machines selection (VMs) in cloud-IoT health services applications to efficiently managea big amount of data in integrated cloud IoT. The proposed model is implemented using three different proposed algorithms using GA, PSO, and PPSO optimizers. The proposed model aims to find the best selection of VMs to help stakeholders in reducing execution time. The proposed model is tested against the state-of-the-art method to evaluate its effectiveness. The results show that the proposed model outperforms on the state-of-the-art models in total execution time the rate of 41.8%. Also, The results show that the proposed model dramatically improves the system efficiency by 5.2%.

9- R .O. Aburukba and et al.(2019)[16]: This work modeled the scheduling problem for IoT requests to minimize time in hybrid Fog-Cloud computing using integer linear program in order to minimize time the overall service request task. This work presents a customized implementation of the genetic algorithm (GA) as a heuristic approach to schedule the IoT requests to achieve the objective of minimizing time the overall job. The GA is tested in a simulation environment that considers the dynamic nature of the environment. The performance of the GA is evaluated and compared to the performance of waited-fair queuing (WFQ), priority-strict queuing (PSQ), and round robin (RR) techniques. The results show efficient for the proposed approach is 21.9% to 36.6% better than the other algorithms. The proposed approach also showed significant improvement in meeting the requests deadlines by up to 20%.

Therefore, the proposed system can be differentiated from the above state-of-the-art method by offering ICPSO algorithm for improvment scheduling MV depented probablity distributing in a cloud computing find best sever reduce cost time healthcare applications and flag alert for monitoring server.

1.3 Problem Statement

The problem of scheduling tasks and work in the cloud computing has become one of the most important growing problems experienced by the health care system in the intensive care unit, which is based on IoT technologies, the area of the medical body in monitoring the patient continuously in real time remotely that generates large data that needs processing and analysis service And storing them very quickly and this causes many problems in delaying the implementation time or giving

priority to implementation according to the type of tasks traffic congestion so the care system based on patient monitoring needs a more effective way to reduce the implementation time.

1.5 Aim of the Thesis

The aim of this work is to design, implement and handle task scheduling patient data vital indicators (blood pressure (systolic ,diastolic), heart rate and glucose level), cloud computing, intensive care unit, using the modified technique discrete (ICPSO)algorithm, which depends on the possibility of distribution, to find solutions in reducing time cost implementation, patient status monitoring and data analysis using flag.

1.6 Outline of Thesis

The other chapters in this thesis are as follows:

Chapter Two: Theoretical Background

This chapter presents the explain IoT technology and healthcare system in IoT and cloud computing technology and technique using scheduling cloud.

Chapter Three: The Proposed System

This chapter describes the proposed system with its design and implementation.

Chapter Four: Experimental Results and Evaluation

This chapter explains the results and evaluation that have been getting from the proposed system.

Chapter Five: Conclusions and Suggestions for Future work

This chapter gives a list of conclusions derived from the results of the presented work and some suggestions for future works.

Chapter Two

Theoretical Background

Chapter Two

Theoretical Background

2.1 Introduction

In the current chapter the basic theoretical aspects of technology 'IoT' and cloud computing efficient in health system services are presented, a brief introduction to health system is given and how the technology wireless body area network works the which can be used to measure the medical physiological signal. It presents the background for various necessary preprocessing issues and techniques that had been used in this work.

2.2 IoT

'IoT' is a new revolution of the internet thanks to the ability to connect remote and mobile things or machines or assets through the use of wireless communications and low cost sensors computing and storage devices. So, the internet is now advancing from a network of computers to a network of things [15]. 'IoT' is one of the most promising technologies in Information and Communication Technology for the last decades. At the center of the 'IoT' paradigm lies the idea of adding more identifying, sensing, computing and communication capabilities to physical devices that previously not designed for this purpose. 'IoT' really does is to transform data into information, knowledge and finally wisdom. As a result, humans can build a holistic view of the object of interest and act accordingly [16].

Especially in the field of sustainability, 'IoT' helps to collect different environmental parameters effortlessly and eventually turns them into statistics, knowledge and actions. There is a long list of current 'IoT' applications, and the list is still going on. 'IoT' is currently present in (energy management, environmental management, healthcare, transport and traffic management, logistics, and inventory management [17].

All applications of 'IoT' can be grouped into four main application domains:

1- Transportation and logistics.

2- Healthcare system.

3- Smart environment (home, office, plant).

4- personal and social.

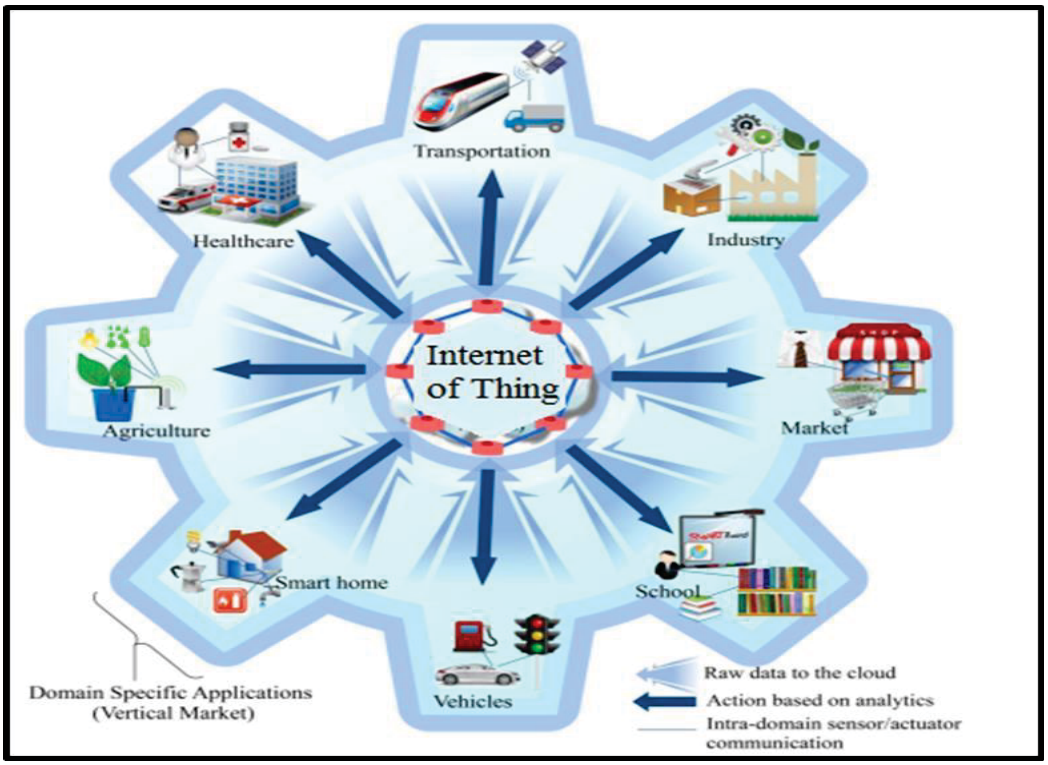

Figure (2.1): Illustrates the 'IoT Applications Domain Specific [16].