A Novel Mobility and Connectivity Aware Stable Clustering Approach for Effective Communication in Flying Ad-Hoc Network

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Abstract—Flying Ad-Hoc Network (FANET) is a network which consists of group of Unmanned Aerial Vehicles (UAVs) that are interconnected in a wireless medium. FANETs are self-organized with few special characteristics such as low cost, user friendly, easy to deploy, fast performance and collectively adaptable to any kind of situation. Due to its high mobility and dynamic nature it consists of certain design challenges to achieve effective communication. Attaining effective performance with lower energy consumption in FANETs is quite complication task. To overcome this drawback in this research A Novel Mobility and Connectivity Aware Stable Clustering Approach (MCASC) is proposed. Significant parameter-based cluster head (CH) selection is performed by considering the parameters such as distance, mobility factor, residual energy, network connectivity, and correlation factor. High mobility of the UAVs is intelligently controlled by this CH selection process which helps to reduce the energy consumption and delay likewise increases the delivery ratio and energy efficiency. The proposed MCASC-FANETs are implemented in NS2 and as well the parameters which are considered for the process of comparative analysis are energy efficiency, energy consumption, packet delivery rate and end-to-end delay where the outcome is compared with the recent approaches like JRUC-FANET and CBRP-FANET. From the results and discussion, it is understood that the proposed MCASC-FANETs attain high efficiency and packet delivery ratio when compared with the earlier researches.

Keywords—Flying Ad-Hoc Network (FANET), Unmanned Aerial Vehicles (UAVs), cluster head (CH) selection, Mobility and Connectivity Aware Stable Clustering
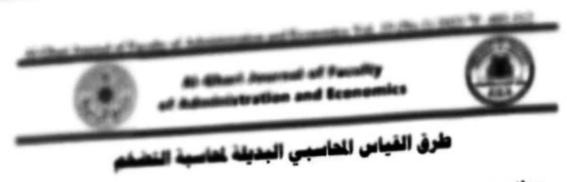
I. INTRODUCTION

Flying Ad hoc Network (FANET) is the emerging promising networking paradigm that consists of multiple numbers of Unmanned Aerial Vehicles (UAVs) that fly autonomously in remote sensing areas. Due to the characteristics of FANETs it occupies the leading position in intelligent transmission system [1-3]. FANETs are used in several intelligent communication based applications such as road traffic surveillance, civilian and commercial applications, remote sensing in military application, border monitoring, rescue operations and so on. Some of the unique functionalities of FANETs are that it maintains high speed, multi-dimensional mobility, dynamically fast changing topology and improved vehicle distance [4]. FANETs are the separated technology from the Mobile Ad hoc Network (MANET) [5-6] and Vehicular Ad hoc Networks (VANET) as well as it maintain very high speed when compared with it [7-11], UAVs are highly recommended for effective communication hence it is more flexible, survivability, scalable, cost effective, maintain simple deployment procedure with squad formation as well as maintain high speed. The UAVs are equipped with inbuilt rechargeable battery, it consumed less processing energy, low computation complexity and it can able to achieve high throughput during the process of communication in the networks [12]. The major complexity in UAVs is optimal deployment hence improper localization results in ineffective communication. To perform optimal deployment in UAVs in this paper we proposed novel mobility and connectivity aware stable clustering approach for FANETs. The contribution of the research is described.

A. Research Contribution

In order to improve the effectiveness of data transmission in FANETs, stable communication in UAVs are concentrated by introducing the novel approach called Mobility and Connectivity Aware Stable Clustering Approach (MCASC) which is mainly used to overcome the drawbacks such as high energy consumption and delay. The parameter based CH selection is performed using the parameters such as distance, mobility factor, residual energy, network connectivity, and correlation factor. Through this CH selection process effective communication is attain in FANETs. The performance is measured using the parameters such as energy efficiency, packet delivery rate, end-to-end delay and energy consumption.

The rest of the paper is organized as below. In section II the related study about FANETs performance are discussed. In section III, the proposed MCASC-FANETs approach is elaborated. In section IV, the performance analysis of the proposed MCASC-FANETs approach is calculated. In section V, the results are discussed. In section VI the conclusion and the future works are shown.

طرق القياس المحاسبي البديلة لمحاسبة التضخم

Alternative accounting measurement methods for inflation accounting

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المستخلص

هدف البحث إلى بيان الآثار السلبية التي يسببها الارتفاع في المستويات العامة للأسعار على قوائم الوحدات الاقتصادية عند تجاهل الوحدة الاقتصادية ذلك الارتفاع ، وبيان أثر ذلك على نتيجة اعمال الوحدة الاقتصادية ومركزها المالي ، من خلال بيان الأثر على بنود القوائم المالية ، إذ أخذ البحث بنظر الاعتبار تطبيق المعيار المحاسبي الدولي 29 في فترات التضخم وبيان استعمال أي الطرق المحاسبية الصحيحة في عملية القياس المحاسبي ، ولكي تحصل الوحدة الاقتصادية على نتائج قياس اقرب إلى الحقيقة عليها العدول عن طريقة القياس التاريخية واستعمال الطرق المحاسبية الواردة في المعيار المحاسبي الدولي 29 ، فالأرقام التاريخية في فترات التضخم لا تعكس الصورة الحقيقية لواقع الوحدات الاقتصادية .

تم استعمال الكلفة التاريخية المعدلة في تعديل القوائم المالية للوحدة الاقتصادية محل البحث ، باستعمال مؤشرات الأرقام القياسية لفترة الدراسة والمنشورة من قبل وزارة التخطيط العراقي – الجهاز المركزي للإحصاء ، وتم تعديل كافة البنود غير النقدية الواردة في القوائم المالية بالاعتماد على ما جاء في المعيار المحاسبي الدولي 29 ، وتم التوصل إلى نتيجة اعمال ومركز مالي اقرب لواقع الوحدة الاقتصادية محل البحث يمكن الاعتماد عليها في اتخاذ القرارات كونه يعبر عن واقع الوحدة الاقتصادية في تلك الفترة ، أما بنود القوائم غير النقدية فهي لا تعدل وإنما تم احتساب مكاسب وخسائر القوة الشرائية لها نتيجة الاحتفاظ بها .

وتوصل البحث إلى نتيجة مفادها أن تطبيق المعيار المحاسبي الدولي 29 في فترات التضخم واستعمال الطرق المحاسبية البديلة عن التكلفة التاريخية لها أثر على اعطاء صورة أكثر وضوحاً عن واقع الوحدة الاقتصادية في فترات الارتفاع في