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Modelling WhatsApp Traffic Control Time-Based (WTCTB) for 5G Mobile Network

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Abstract - Utilizing of the WhatsApp application in recent years, especially in the last ten years, is an increasing use and the way it is exponentially increasing. With the development of mobile phone generations and what the fifth generation technology (5G) is looking forward to, it become necessary to have a mechanism that controls the traffic in the WhatsApp application in the fifth generation technology (5G). In this article, a model called WhatsApp Traffic Control Time-Based (WTCTB) was proposed, which synchronizes with WhatsApp usage times and reduces traffic in secondary-priority applications as well as saving time consumption for traffic flow in addition to saving energy consumption in the phone battery in the sixth generation mobile networks. WhatsApp application is normally consuming more than 40% in almost smart phones of their battery energy, the proposed model WTCTB is reducing this consuming rate to be 35%.

Keywords - WhatsApp, traffic control, traffic flow, 5G, battery energy

1. Introduction

In fact, the mobile communication revolution began when the third generation began to appear, and the Internet began to be used at that time, in addition to the use of multimedia means. After that, the mobile phone revolution was in the fourth generation, as the actual internet speed became more than five times what it was in the third generation. In addition to the increase in the number of subscribers, "active users", which is called in the world of telecommunications by increasing the capacity [1].

These increases in speed and capacity in the third and fourth generations were accompanied by a significant development in communication programs that depend on Internet service, and perhaps the most important of these programs is the WhatsApp program [2]. WhatsApp is an instant messaging application that can be used on different types of devices, such as smartphones that make up iPhone and Android devices, in addition to computers, and WhatsApp is one of the most widespread and popular instant messaging applications in the world, due to its being free, it can be used to communicate with other users through the cellular data network on the user's phone or through the Wi-Fi network [3].

The WhatsApp application was launched in February of the year 2009 AD by Brian Acton and Jan Koum, who were former employees of Yahoo, and the application was released for the first time in the iPhone application store in August 2010 AD, and the application relied on displaying cases for users next to the existing names via the user's phone; As a means of communication between people instead of regular text messages, the WhatsApp application succeeded in obtaining the admiration of users, as the number of its users within a few months reached approximately 250,000 users [4].

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The WhatsApp application, when it was invented, was only available through the application store for iPhone phones, then it was added to the application store for phones running the Android operating system at a later time in 2010 AD, which is the same year that witnessed the addition of the location sharing feature with other users, and developments and improvements continued. The year 2011 witnessed the launch of the group chat service. This made the number of messages sent through the application reach nearly one billion messages per day, and the year 2013 witnessed the launch of the service of sending voice messages through the application [5].

The WhatsApp application is considered one of the most widespread and popular instant messaging applications in the world, as this application is used effectively by more than 2 billion users per month, and the years between 2016-2020 had the largest percentage of new users through this application, as it Only those years witnessed the registration of one billion new users, and the country of India occupies the first place in the number of WhatsApp users; It is used by approximately 390 million Indian people per month, and it should be noted that more than 100 billion messages are sent through the WhatsApp application daily [6].

With the rapid technological development in the smartphone industry in the last five years, technologies related to battery manufacturing and applications have made significant and significant progress for the purpose of saving energy and extending the life of batteries while allowing heavy-use applications to synchronize, allowing these applications to benefit from modern batteries. Both battery life and cost issues have improved more recently, making battery storage the most popular and fastest growing type of energy storage technology [7].

Electronic communication has become an essential part of human interaction, so everyone needs communication, whether social, personal or even scientific communication [8]. Over the recent years, communications have evolved with the competition of companies to produce the best programs and technologies to be able to make phone calls and have a conversation; Not having to write

Long messages with everything you need to say at once and wait for a week or more to get a response as it used to happen in the old mail or handwritten letters. Owning a mobile phone for all age groups and all levels of users has become an essential thing for the continuity of life, daily dealings and communication [9].

From this point of view, the study of statistics on communication programs has become an important matter, especially for those who work in the field of mobile communications, so the WhatsApp application was the main concern of many of those interested in the field of technology, especially after the launch of the fifth generation of mobile communications.

2. Related Works

Chen et. al. proposed a real-time system to perform distinguishable traffic services [10]. The proposed system utilized short traffic series to enhance the ability of recognizing traffic services. The authors collect their data from commercial LTE networks. Their results shows an increase to accuracy percentage that greater than the baseline.

De Masi et. al. developed different data collection approaches and schemes selection operations to make training multiple expectation QoE systems [11]. In this study, an increasing of the performance compared to the users prediction based on-device prediction system applied to the smartphone.

Seufert et. al. utilized very big data set of about 6000 private WhatsApp chat histories, that consist of over 75 million messages which have obtained from more than 117,000 users [12]. This study, define and build the main properties of users and chat groups as well. The authors applied standard measurements for the most recent and popular text message kinds, which allow the proposed system to evaluate the traffic during time through a chat group .

Thieme et. al. studied the main properties of MIM, Instant Messaging (IM) and Short Message Service (SMS), for most recent and popular studies [13]. In this work, the authors make comparison with these recent studies based on modern applications which support short messages and they conclude that with an accurate paradigm of nowadays SMS, for whom huge datasets available and are then it so easy to access, MIM may be modelled to some extent, also.

Erdenebaatar et. al suggested a data driven scheme by utilizing classification approach in machine learning systems [14]. This study aims to making analysis and also making identify for various encrypted six traffic. Their results approved that it is not difficult to identify and knowing the behaviour of various input traffics for applications which support short messages.

Shubha et. al. focused on WhatsApp and such applications that utilizing messaging protocols and Voice over Internet Protocol (VoIP) [15]. This study shows the high ability to differentiate between multiple video and audio calls in the flow of traffic, especially by blind detection of the flow of traffic, which is applied, tested and then implemented in this study.

Espinal et. al. proposes to rely on knowing the bandwidth size and thus enables us to make an analytical comparison of the bandwidth size between many different Internet applications, especially communication applications as well as the most used text messaging applications in smart phones [16].

Baydeti et. al. proposed an intermediary application to control social media traffic, and from it a distributed business model based on the Internet was built to study and analyse the real-time peak traffic flow used for these applications [17]. The results and analytics conducted in this study show a 27% reduction in total traffic initiated with sufficient amount of data for end users.

Chaudhary et al. the. Worked on a short-lived threat model to gain acceptance against PC clients and performed an estimation impact analysis of two popular risk evocation frameworks, STRIDE and LINDDUN [18]. The results show that the machine developer wants to understand the adversary in the evolving context within the systems function and, more importantly, mitigate it by re-certifying the boundaries in such a way that those within the administrative boundaries cannot violate their protective and private properties.

Ghanem et. al. studied the effects of national culture on the linkage between social media marketing instruments [19]. This study focuses on the influence of nowadays media programs and application such as Facebook, WhatsApp, Twitter and Email. This study worked on surveys method and used questionnaires to accumulate applicable information from the respondents. The mannequin used to be developed the usage of SPSS and AMOS software program as the research is quantitative in nature.

Rathbone et. al. analyse WhatsApp data identifying five core topics relevant to mobile communications and instant messaging applications [20]. These topics are: occupational development, speciality of examiner, advanced relations, balance approves and communication effectiveness.

Kaufmann et. al. introduced and assessed the mobile instant messaging interview (MIMI) [21]. In order to approve their study, the smartphone users are proposed, concluding the positive main points and dis-advantages of MIMI in more details, starting from the author's in addition to the participant's point of view.

Cruz et. al. suggested modern and different means on how to transform a technology into an infrastructure to support the WhatsApp communication application [22]. Accordingly, a large group is formed consisting of the various daily activities carried out by WhatsApp users for various real-life personalities, whether they are political figures. Or economic or even spiritual, from personal to economic, and from spiritual to political. And the embodiment of all these for the purpose of achieving and analyzing the exchange of data in the use of the WhatsApp application.

3. Method

Inter-packet delay is expressed as the main source traffic for almost mobile communication usage even it is may generate abnormal traffic but with an effective modulations in 5G it lead to neglect the mentioned problem. After the traffic has been generated while the mobile device is accessed the nearest and strongest mobile base station site. As shown in figure 1, if the mobile station located in location 1 then it will receive its traffic data from base station 1. While if the mobile station located in location 2 then it will receive its traffic data from base station 2. Finally, if the mobile station located in location 3 then it will receive its traffic data from base station 3. This scenario is automatically achieved by Mobile Switching Centre (MSC) which depends on the signal strength with a main synchronization with the mobile station battery energy and capacity.

After source traffic generated and with willing to utilized WhatsApp application by mobile station, the WhatsApp application has been initiated as shown in figure 2. Data exporting applied, it is mean that the extraction and conversion of raw data from the current data format to the desired format. This stage mean in another words, data is backed up changing its location between two different applications, programs and devices.

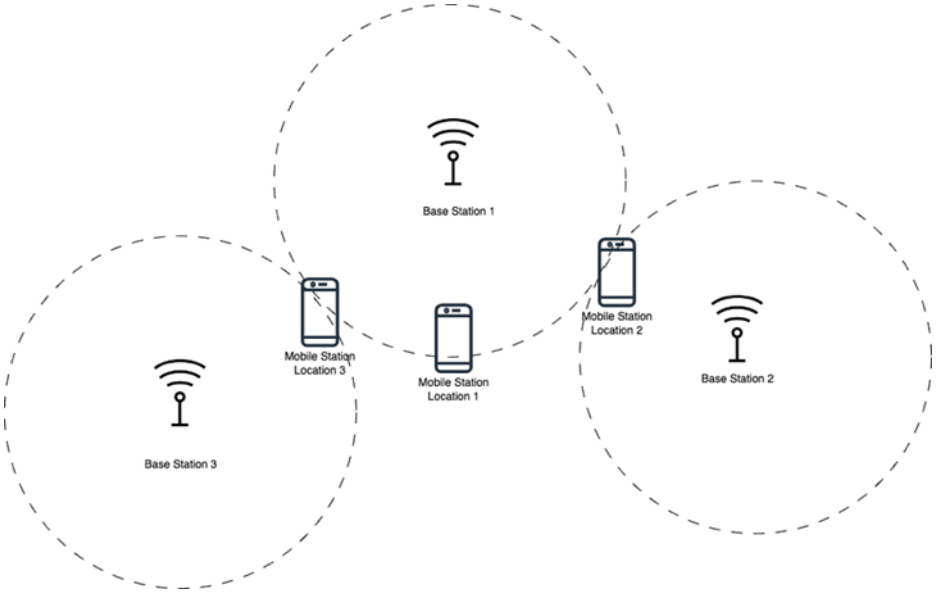

Figure 1: Mobile station and base station traffic flow based signal strength.

At this stage, data loading is applied by means WhatsApp is starting to load the intended data. Directly after the data is loaded successfully, the dada is reprocessed to meet the required process i.e., video call, voice call and/or data transfer. For meeting the main goal behind this article, which are saving time consumption for traffic flow in addition to saving energy consumption. This will be achieved by applying synchronization. If correctly the synchronization is applied then traffic control is applied in order to control the traffic based on the time in day while the WhatsApp is utilized.

Mainly, the time in day play a core role at this step by depending on the analysis of WhatsApp utilization in Iraq with taking the busy hour into the consideration. In addition to that, the statistical analysis shows the usage of WhatsApp based on the ages as shown in Table 1.

Table 1: Age variation usage distribution of smartphones.

Age Group	Percentage
Under 2 Years	1
2 – 4 Years	7
5 – 7 Years	28
8 – 10 Years	30
Over 10 Years	34
Total	**100**

Table 2 shows the statistical analysis of frequently WhatsApp usage. All the visual statistical analysis shown in Table 1 and Table 2 have been applied in Iraq as a case study and the main results are shown in section 4.

Table 2: Frequently WhatsApp utilization.

Utilization	Percentage
Never Use	3
About Once a Month	4
Once a Week	9
Once a Day	11
Twice a Day	13
3 – 5 Times a Day	20
6 – 10 Times a Day	26
11 – 15 Times a Day	6
More Than 16 Times a Day	8
Total	**100**

Mainly, if the synchronization is failed to applied correctly then the process od data reloading with the consecutive processed will be re-applied. The rest of the proposed system process which are data analysis and data visualization will work properly while the synchronization correctly works. Figure 2 shows the flowchart for the main steps of the proposed model.

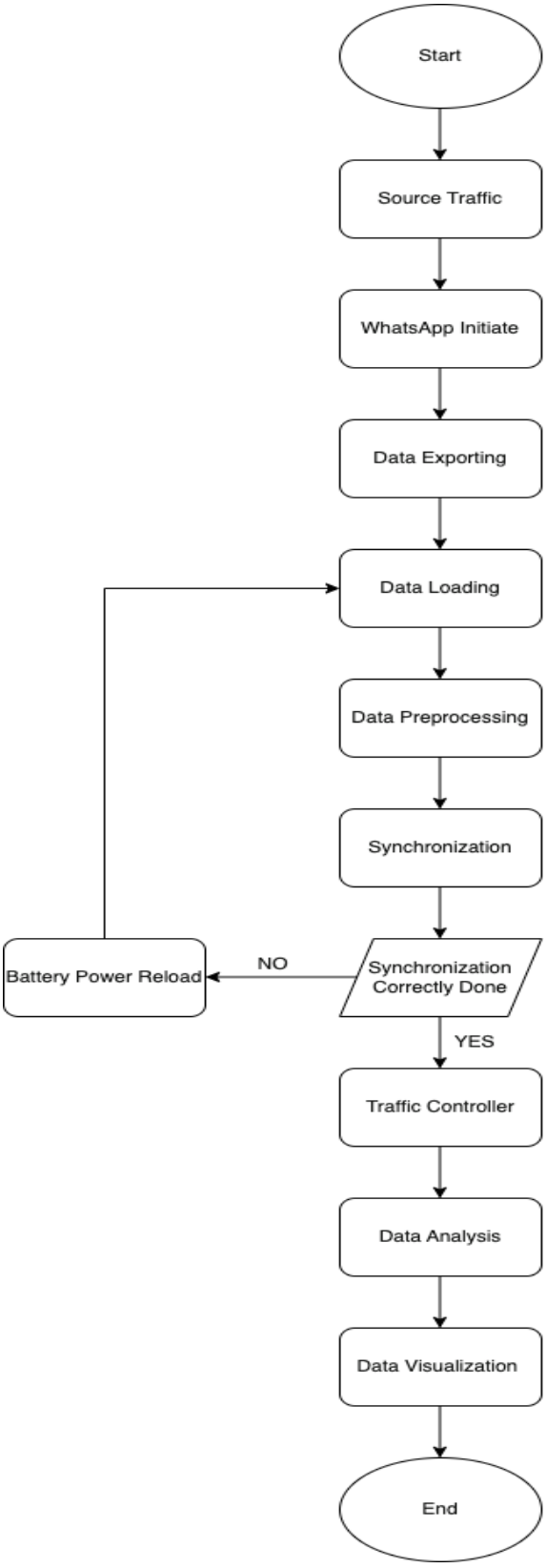

Figure 2: Flowchart for the proposed model WTCTB

In order to understand the most important goal for the proposed model see equation 1. The two parameters which the battery time calculations are Battery Capacity (mAh) and Charging Current (mA) which lead to calculate the exact Battery Charging Time [23]. A battery can be charged with a current of about 10 % of the battery capacity. Following equation or formula is used for Battery Charging Time calculator.

$$Battery\ Charging\ Time\ (in\ Hours) = \frac{Battery\ Capacity\ (in\ mAh)}{Charging\ Current\ (in\ mA)} \quad (1)$$

The electric charge which stored in a battery is mainly measured in Amp-hours or Ah for short. While, electric energy normally stored in a battery itself and it is measured in Watt-hours or Wh for short [24]. Equation (2) is used to measure the charge as follow:

$$C_A = I_{Battery} . t \quad (2)$$

Where:

C_A is the electric charge (C from Coulombs)

$I_{Battery}$ is the battery current.

In the same way, the battery capacity is denoted as the stored energy. That mean we are intended to enhance the energy stored in a battery based on the proposed model. The proposed model is applied to enhance the energy saved based on equation (3) below:

$$C_W = C_A . V \quad (3)$$

Where:

C_W is the energy

C_A is the charge capacity.

V is the voltage of battery

As the voltage V is known and also charge capacity C_A is normally being specified [25]. Then it is easy to calculate amount of energy C_W based on equation (3) above.

4. Experiments and Results

This section is divided into two main parts, the first part explains the detail environmental setup while the second part shows the simulation results for the theoretical section of the proposed model as follows.

4.1 Environmental Setup

The experimentations of the proposed model are achieved by using MATLAB tool with the using of some of tool boxes and libraries such as LTE, 5G, communication and signal processing while the main and real environment is produced for WhatsApp video traffic between two smart phones in order to resolve the proposed model. The transmission channel parameters are in way of the practical smart phone's infrastructure. The latency is between 12–22 ms. The maximum bandwidth of the transformation channel is 4 GHz and the value of the spectral efficiency is about 120 bits/second. The peak value of the data rate is 8 Gbits/second. As the given parameters and properties, the communicating two sides (i.e., sender and receiver) are trying to make WhatsApp call normally by applying the proposed model.

4.2 Simulation Results

The statistical analysis applied in Iraq which have shown in Table 1 and Table 2 are implemented based on WhatsApp usage in first month in 2023 after applying the proposed model WTCTB to deal with the WhatsApp call density as shown in figure 3. The most important thing should be noticed in this figure is that the traffic density result after applying WTCTB is normally distributed for both TCP and UDP which means that the synchronization time-based is correctly implemented and the energy save doesn't create abnormal traffic distribution.

Figure 4 shows that the bit rate of the WhatsApp used after applying the proposed model WTCTB doesn't exceed the threshold bit rate call. The blue curve in this figure is the bit rate for the WhatsApp before applying the proposed model WTCTB while the red curve is the bit rate for the WhatsApp after applying the proposed model WTCTB and that lead to the fact is the proposed system save capacity for the WhatsApp application after applying on it.

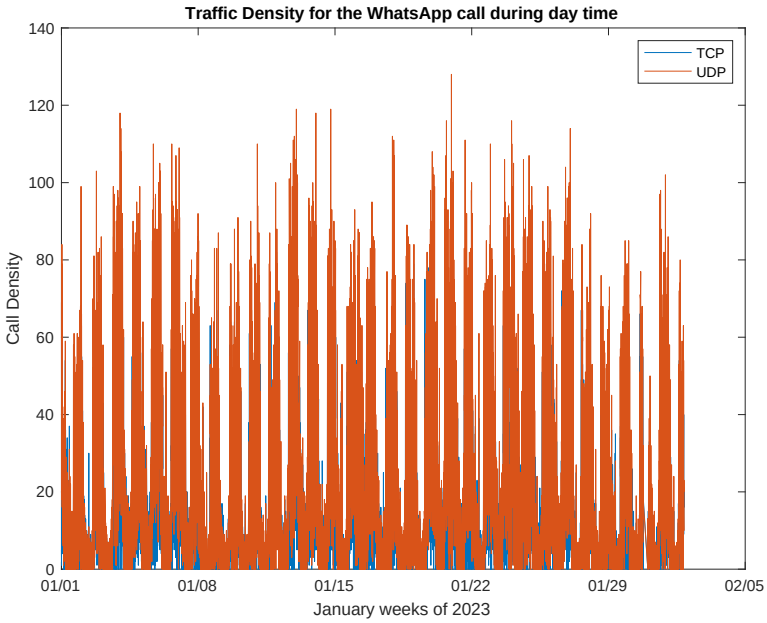

Figure 3: WhatsApp call traffic density during day time after applying the proposed model WTCTB.

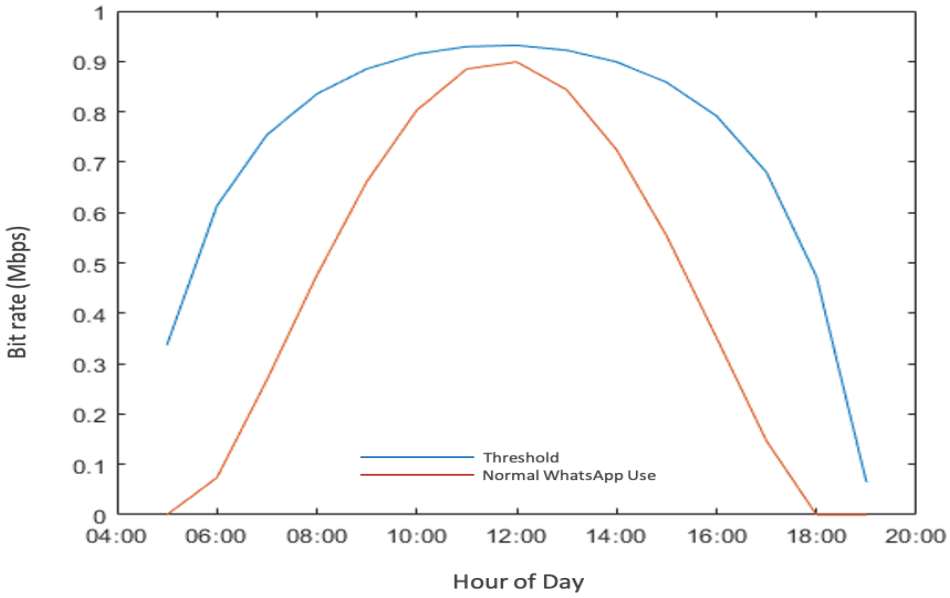

Figure 4: Bit rate before and after applying the proposed model WTCTB.

In order to achieve the other main goal for the proposed model, equations (2) and equation (3) have applied on smartphone mobile type iPhone 14 Pro Max and applying the proposed model WTCTB on it, the results on figure 5 shows a great battery save (blue chart bar) which approve the main goals for the proposed model WTCTB. As applied in the experimental process, WhatsApp application is almost consuming more than 40% of the battery energy, but after applying the proposed model WTCTB this percentage rate is reduced to be 35%.

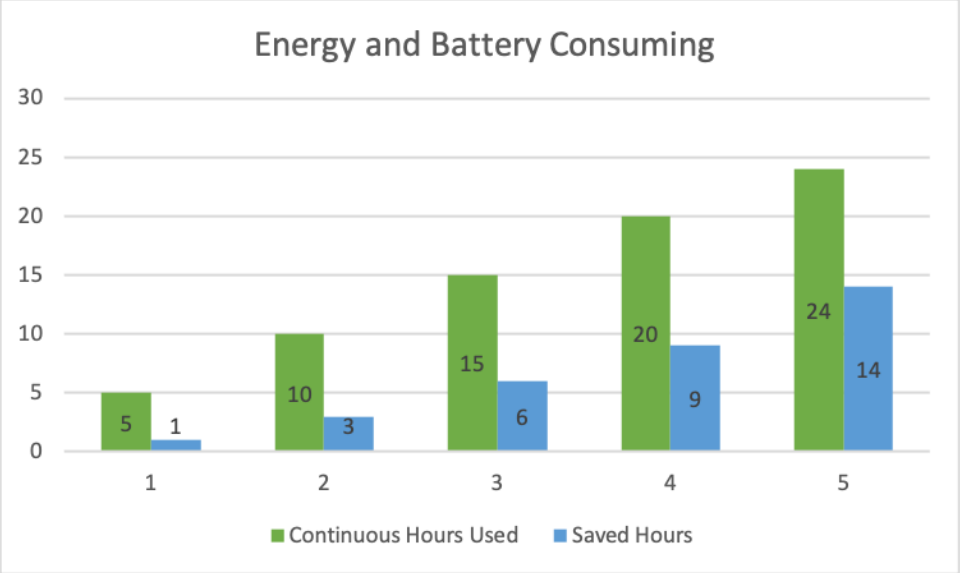

Figure 5: Energy and battery consuming after applying the proposed model WTCTB.

5. Conclusion and Future Works

In this research, a proposed model WTCTB was applied which allows synchronization based on the time pattern, and this synchronization takes place when using the WhatsApp application in mobile networks. This synchronization was included in the steps of building the proposed system in order to provide battery energy save based on the work of a statistical study on the times of using WhatsApp and the categories that use it, as well as the data source that determines the traffic that WhatsApp deals with, and thus an additional capacity is gained that is added to the basic goals of building the proposed model WTCTB which was applied to the two protocols UDP and TCP, and the results showed that the proposed system works smoothly and without generating irregular traffic, in addition to saving part of the battery energy while using WhatsApp. WhatsApp version 2.19.308 and later is causing some issues in phones and causing battery drain on many Android phones. According to the study and analysis of the data of WhatsApp users, after which the analytical results appeared in the two tables, Table 1 and Table 2, the WhatsApp application consumes more than 40% of the battery energy, so the application of the system proposed in this article WTCTB and the results it showed reduced this percentage to be 35% and this One of the goals that have been achieved behind this article.

As a future advice, I offer it, which is to expand the study and comparison to include other programs and applications and to know their parameters. I also recommend adding a security feature and taking it into account to avoid possible breaches and loopholes.

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