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Long Duration Multimedia Content-Aware Energy-Saving Learning Adaptation for Mobile Devices in Smart Environment

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Abstract: The capabilities and high internet data rate on mobile devices increased remarkable due to which it becomes popular to access multimedia learning resources online on mobile devices. As mobile devices get power from a battery source which is limited in capacity so it is a serious issue and challenge needed to be resolved to enhance the mobile learning duration and increase the user experience. The multimedia learning is limited on mobile devices as high quality multimedia is greedy in power hungry and depletes the battery rapidly. How to enhance the battery life by inventing the techniques to save battery power has great interests by the researchers due to low progress in battery capacities improvements. The existing power saving techniques reduces the quality of multimedia resources to enlarge the battery capacity which may liable to loss of information that is harmful to learning process by affecting the content learning efficiency. The already work one in learning efficiency of multimedia content adaption process needed to more improvements to increase the efficiency of multimedia content learning. The adaptive multimedia techniques suggested by researchers reduce the quality of multimedia resources on the move to improve the battery life efficiency. Existing multimedia adaptive techniques gain energy efficiency at the cost of reduced quality and information loss. Mobile learner may lose interest in accessing online educational multimedia content learning due to low quality contents and frequent lose of information. This may also result in overall reduction of battery power of mobile devices. An adaptation approach for long duration especially education multimedia also focusing on learning aspect for enhancing the battery life by saving power is proposed. The proposed approach manages the delivery of multimedia content on move at a reasonable quality to keep learning resource effective and also enhance the battery life. To address the challenge of limited battery life, this paper suggests increasing the efficiency of long duration multimedia content leering on mobile devices by saving battery power.

Keywords: **mobile devices, multimedia learning, long duration multimedia content, saving battery power.**

1. INTRODUCTION

The multimedia content learning on mobile gain popularity in recent years due to availability of higher processing mobile capabilities and high speed data transfer speed on internet. Powerful mobile devices are becoming inexpensive and affordable for everyone. High data rate internet connectivity is possible due to incredible advancements in wireless technologies which make it possible to access multimedia contents of high quality. Due to these advancements in mobile devices and wireless technology multimedia contents are in access of mobile users for education anywhere and anytime [1]. Smart mobile phones also equipped with latest sensors, GPS, wireless modes, cameras, Gyro Scope sensor, power hungry apps including multimedia aspect along with high speed CPU cores on a system on a chip (SoC) running from the power of a battery source. Over the year advancements in computational and sensing capabilities of mobile phone components multiplied at very high rate and require consuming more power which put tremendous affect over the battery

life. Techniques invented to enhance the battery life but advancement in battery capacity is at very small scale compared to the improvements in other mobile phone characteristics. Usage of mobile phones to access multimedia resources online consume more power and become the cause of battery drain due to high rate of data transfer over wireless network. This factor reduced the learning duration so enhancing accessing time of educational online multimedia resources is a big challenge due to limited battery power. Many Institutes and individuals provide free videos of educational contents which increase the chances of educational learning on mobile devices. The control over where and when to learn by mobile users make it popular increasingly what to learn by the mobile learners [2]. However many challenges required considerations still to be addressed.

2. LITERATURE REVIEW

Due to major development in mobile phone capabilities and bandwidth of data network connectivity smart phone become famous, availability of multimedia contents online provide the access to large multimedia contents anywhere, any time and have choice when and where what to learn, the user interest in mobile learning become popular [1]. Mobile devices vary in capabilities like battery power, network bandwidth, screen size and processing. In the context of learner's use and need rich research was conducted in adapting learning resources [4].

There is large heterogeneity in network connectivity, needs of mobile learner and mobile devices which makes the mobile learning unsuitable approach. To enhance and making more efficient learning experience learning resource personalization and adaptation is used. To take the better benefit of resource constrained device and limited time assist the mobile learner. Memory size, network features, battery power capacity and screen size are the resource constraints in mobile devices which are studied in [4] [5] [6] in the context of mobile learner's need and learning resource adaptation. The delivery of mobile learning contents constitutes some challenges. In [3] techniques for personalization and multimedia adaptation developed.

The transmission of large amount of multimedia video mobile devices faces challenges of power along with varying network connectivity which are needed to overcome. Applications required managing mobile video to achieve energy efficient video **[**3]. To make the multimedia streaming energy efficient avoids unnecessary transmissions over 3G and may need to build a short range network of nearby mobile devices to share multimedia videos provides better throughput and battery life **[**5**].**

Usually, Universal multimedia access and content adaptation approaches used in [7] reconstruct multimedia contents to use on resource constraints mobile devices. Slow improvements are seen in battery technology as compared to mobile devices other characteristics. Mobile learners are unable to learn for more time due to limited battery power. The batter power drains rapidly due to huge data transfer on accessing educational multimedia contents from web on mobile network as large portion of battery power is utilized by mobile device wireless interface. Two times less power is used in viewing local multimedia file than accessing it from web [9]. Many researchers addressed energy efficiency in this area to now, not appropriate for educational multimedia adaptation because learning factor is not considered. To make possible learning techniques to save power suggested in [10].

3. MOBILE POWER MANAGEMENT CHALLENGES

Battery power utilization is a large design consideration for mobile devices from many years [6]. Wide research is conducted to analyze the energy efficient approaches within available budget of power and processing. With the increasing use of smart phones, the crises of battery power also increased. The advancement in power efficient batteries is not enough remarkable as compared to the advancements in mobile devices with increasing computational power, large sensing devices attached, increased storage, high speed data transfer communication network technology which consumes more battery energy while the improvements in battery capacity is not accordingly, also the widely increasing power hungry applications are used on mobile devices. So the user experience for performing different learning activities and exploring multimedia content affected due to which more energy efficient battery power management techniques for mobile devices are needed to be advised. Different factors like user experience, optimization at platform level and platform view for power management of smart phones are studied in this paper.

A. Platform View:

Central processing unit uses a little portion of power consumed by overall system. Now days the multiprocessor system on chip was replaced the CPU. All the components like memory controllers, graphics cores, CPU cores, sensors etc are integrated on a single chip [11]. Different tasks are assigned to processing elements and unused resources kept in low power states to gain energy efficiency [2]. MPSoC and other components like display, wireless modems, Bluetooth, camera, sensors and memory needs considerable focus in term of cost and power consumption [2]. Display component of mobile devices with brightness level and system activities consume major portion of battery energy [2]. Hence platform in smart mobile's phone power management realizing different hardware resources carefully organize for energy efficient operations

B. User Experience:

Mobile phone devices used for multiple perspectives. The modern smart phones having CPU cores and graphics processing units are used to perform conventional graphic and computational tasks. Simultaneously used for advanced location aware services and applications as mobile phones equipped with GPS, sensors, Gyro scope, camera's and wireless modems [7]. Some tasks requires high video quality like games while others may needed faster response time such as touch and basic phone functionalities [5]. Mobile phone usage perspective and user experience may considerably affected by these different components consuming varying level of energy. CPU-bound tasks influenced the CPU power whereas navigating apps influenced the both display and GPS. So all these along with phone calls etc influence the overall power consumed by the SoC.

C. Optimization at Platform Level:

To consider the whole stack of diverse hardware's is critical to consider for mobile platform evaluation. Power management may result in poor for decisions isolated in hardware or software stack. So it is better to optimize power of whole platform instead of reducing energy consumption of SoC or CPU alone because power efficient procedure initiates at application layer most efficiently instead of at hardware resources. The operating system of smart phone effectively manages the hardware resources to meet the requirements of application to reduce the power consumption [3]. Research statistics emphasize to cover the energy aware operating systems responsible to manage the energy consumption in user interaction, sensors, processing, protocol optimization, and assign low power states to hardware etc since close synchronized coordination between operating system, device drivers, hardware and application may result to achieve energy efficiency.

D. Hierarchical Control Architecture:

The power consumption can be minimized by performance of specific target which can be maximized by receiving whole power budget in a control structure through control, estimation and decision making optimization. The information obtained by observing the available sensors and hardware monitor can be converted into useful energy efficient way in estimation. In decision making create estimated values for targeted individual components using power performance process to determine and estimate the power require for user experience by the coordination of graphic processing unit and central processing unit [12]. The control process estimate and control the power require consuming by the individual components.

4. EXISTING CONTENT ADAPTED TECHNIQUES

1. Energy Efficiency in Multimedia Resource Learning Streaming:

The mobile devices power requirements growing with the advancement in mobile device features like bigger screen, high processing capabilities and high data communication rates as compared to the enhancements in battery power storage capacity [8]. Energy is saved in multimedia adaptation by lowering the quality of multimedia parameter resolution, frame per second, bit rate to improve the battery life as accessing multimedia online is very power hungry [9]. For less battery power utilization multimedia data size is reduced which lower the data transfer through wireless is common rule adopted in energy aware adaption techniques. In [12] techniques for power efficient multimedia were studied.

Power save based adaptive multimedia delivery method make possible last longer the multimedia streaming by selecting multimedia stream quality based on packet loss and battery life left is introduced in [11]. Approaches other than application layer including multimedia traffic shaping use screen brightness [9] in playback and NIC Awake and sleep mode do not reflect multimedia educational resources learning efficiency.

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2. Adaptive Mobile Multimedia Learning and Battery Life Efficiency:

Delivering learning resources efficiently to fulfill the varying mobile devices and needs of learner by transforming learning resources in appropriate version is becoming popular research area. Personalization and content adaptation approach used in adaptive mobile learning make available different versions of same learning content [4]. Learning contents are personalized by these approaches for each learner by knowing his learning styles, preferences, knowledge level, available hardware resources along with constrains like resolution, screen size, processing capability, main memory, network connectivity, software etc and learning context including time, location and current activity of learner.

Adaptation framework to provide multimedia learning resource 5R's for learning contents at right time, right content to right learner, in right location on right device is proposed in [5]. Issues observed in multimedia content learning due to mobile devices varying capabilities are discussed in [2]. Adapted resource learning mode techniques depends on mobile learner's device features, learner's need and preferences are suggested by various researchers over the years [6].

Mobile learning observes the battery life constraint as a big challenge which is improved small in mobile learning applications instead of relying on battery power by incorporating power saving approaches in multimedia content learning resource systems. Many researchers suggest encoding parameters to improve the battery life but focusing on user experience. A solution is proposed to save effective battery power for content adaptation in eco-learn m-learning system [7]. Surveys shows that user learning experience does not affected by multimedia quality reduction to save the battery power by suggesting uniform quality multimedia contents learning. Reduced quality is suitable for short duration in second's multimedia contents whereas educational multimedia contents may extend up to an hour. Jalal et al proposed battery power efficiency in perspective of mobile learning but limited to detecting the online adaptive contents versions efficient for battery in [11].

The existing mobile learning applications adaptation techniques for multimedia adaptation ignore the learning context in multimedia especially in education. So I suggest that educational multimedia adaptation technique to focus the adaptation effect on learning instead of user experience.

5. PROBLEMS WITH USING EXISTING POWER SAVING ADAPTATION TECHNIQUES FOR EDUCATIONAL MULTIMEDIA

Application level power saving adaptation approaches already discussed in research literature to save battery energy while educational multimedia is focused by some approaches that may also have some problems for educational multimedia.

1. Learning result affected by quality degradation is not considered due to lack of content aware due to which decision of lowering quality is implemented for all multimedia contents and may not helpful for learning at point where high quality content is needed.
2. Implementing uniform degraded quality by these techniques on entire multimedia may not provide optimal energy efficiency and remain useless for mobile learners.

These described as:

A. Sacrificed Learning At The Cost Of Battery Efficiency:

To achieve the battery efficiency by degrading the quality of multimedia educational content visual information requiring quality does not considered which may enhance the user experience to access the multimedia content online but may make the useless learning due to degraded quality.

B. Power Efficiency Reduction:

Some multimedia contents may needed high definition quality to gain the learning objectives it is forced to deliver all contents in high quality as result of which more power is consumed. The proposed approach overcome this issue by dividing the multimedia contents into fragments which are ranked according to the need of quality and display only those segments in high quality which needed it and also present the same version in lower quality by sensing the remaining battery capacity which has a positive affect over battery life to enhance power and mobile learner is able to learn educational multimedia contents for the longer duration.

A trade-off exists between battery life and user experience as battery life is enhanced by lowering the quality of multimedia contents in many energy efficient multimedia adaptation techniques [12]. To reduce the quality of multimedia bit rates, resolution, colors and frame per seconds are reduced due to which information is loosed which made the multimedia content inappropriate for learning because of low quality. Multimedia adaptation technique needs to be energy efficient to maintain multimedia quality suitable for learning. In this paper energy preserving content aware multimedia adaptation techniques are suggested to achieve energy efficiency without degrading the learning process.

6. PROPOSED SOLUTION

Long Duration Multimedia Content-Aware Energy-Saving Learning Adaptation Process for Mobile Devices In Smart Environment:

Long Duration Multimedia Content-aware Energy-saving learning adaptation (LDMCA Energy-Saving learning adaptation) process for mobile devices in smart environment is suggested due to ignoring multimedia learning adaptation by existing techniques. Smart mobile phones also equipped with latest sensors, GPS, wireless modes, cameras, Gyro Scope sensor, power hungry apps including multimedia aspect along with high speed CPU cores on a system on a chip (SoC) running from the power of a battery source. Over the years, advancements in computational and sensing capabilities of mobile phone components multiplied at very high rate and require consuming more power which put tremendous affect over the battery life. Techniques invented to enhance the battery life but advancement in battery capacity is at very small scale compared to the improvements in other mobile phone characteristics. Usage of mobile phones to access multimedia resources online consume more power and become the cause of battery drain due to high rate of data transfer over wireless network. This factor reduced the learning duration so enhancing accessing time of educational online multimedia resources is a big challenge due to limited battery power. The adaptive multimedia techniques suggested by researchers reduce the quality of multimedia resources on the move to improve the battery life efficiency. Existing multimedia adaptive techniques gain energy efficiency at the cost of reduced quality and information loss. Mobile learner may lose interest in accessing online educational multimedia content learning due to low quality contents and frequent lose of information. This may also result in overall reduction of battery power of mobile devices. An adaptation approach for long duration educational multimedia also focusing on learning aspect for enhancing the battery life by saving power is proposed. The proposed approach manages the delivery of multimedia content on move at a reasonable quality to keep learning resource effective and also enhance the battery life. The idea is to keep battery power efficiency most favorable while adapted contents remain appropriate for learning. Various quality versions incorporated with entire fragmented multimedia content. The minimum tolerable quality for each fragment is determined in content adaptation considering the learning aspect which retains the fragment appropriate for learning process. A metadata is build to store these minimum suitable qualities required as constraints for relevant fragment. Visual information detail of each multimedia learning video is associated with multimedia content at different temporal point. Each video fragment may require different visual quality affects at different temporal point. Based on this information a top quality presentation constraint is assigned to quality sensitive visual multimedia content fragment. While a low quality constraint usually audio is assigned to a multimedia fragment that does not have any visual information to deliver each part of the multimedia content at lowest feasible battery power cost. Visual fragment contents differ in color, size, motion and detail. Quality reduction of visual information factor of each fragment is considered in this method to make lowest required video quality requirement variable at varying temporal multimedia content points to achieve the multi quality and multimodal presentation quality output of fragmented multimedia video contents.

7. CONCLUSION

To improve the battery life of mobile devices Educational Multimedia Content-aware Energy-saving learning adaptation approach is suggested to achieve the optimal battery efficiency. The idea is that to divide the educational multimedia content into fragments. These fragments have varying visual quality requirements at different time in video, so content-aware mechanism is needed to develop that adapt the quality required by the fragment which definitively improves the battery life. To achieve the best energy efficiency consider the platform components as whole in smart mobile phones rather than focusing on individual components and a close coordination required among hardware control, user experience and energy aware operating system to enhance battery life .

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REFERENCES

[1] Cheung, S.K., "A study on the use of mobile devices for distance learning, in Hybrid Learning," *Springer*,2012

[2] Bradley, " Design and development of multimedia learning objects for mobile phones. Mobile learning: Transforming the delivery of education and training," *Proceedings of International Conference on Advances in Mobile Computing & Multimedia, ACM*, 2009

[3] C.H. Muntean, A.N and Moldovan, " Towards personalized and adaptive multimedia in m-learning systems," *In Proceedings of 16th AACE World Conference on E-Learning in Corporate, Government, Healthcare and Higher Education, AACE*, 2011

[4] P. Aervas and Sampson, " Context-Aware Adaptive and Personalized Mobile Learning Systems," *Springer*, 2013

[5] X. Zhang, R.M.G Kinshuk and Tan, " The 5R Adaptation Framework for Location-Based Mobile Learning Systems," *10th World Conference on Mobile and Contextual Learning, mlearn*, 2011

[6] Zhao, " Personalized Adaptive Content System for Context-Aware Mobile Learning," *IJCSNS*, 2008

[7] C. Christopou;os, T. Ebrahimi and Vetro, " Universal multimedia access," *IEEE*, 2003

[8] Theurer, "Analysis of Individual Energy Consuming Components in a Wireless Handheld Device,"2010

[9] Trestian, " Energy consumption analysis of video streaming to android mobile devices," 2012

[10] S. Weibelzahl, C. Muntean and Moldovan, "Energy-Aware Mobile Learning: Opportunities and Challenges,"2013

[11] N. Gibbins, S.A. Jalal, and David Millard et al, "Content-aware power saving multimedia adaptation for mobile learning," 2013

[12] M. Siekkinen, J. Nurminen and Hoque, "Energy Efficient Multimedia Streaming to Mobile Devices—A Survey," 2012