Study On How Camera Resolution Affect Memory And Battery Usage

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Abstract *— The objective of this study is to observe how much effect does a mobile camera has on its battery and storage. The current generation of smartphones more frequently uses their mobile phone, which decreases the battery life to as short as several hours. Thus, it becomes necessary to understand the effects of different cameras on their battery and storage. How is battery consumed across the different Megapixel Cameras? This paper presents a battery & storage study on smartphones focusing on various brands and models. we had observed 15 Android Mobiles for more than a week of different brands and models, tested its front as well as a back camera having distinct megapixel cameras. We have observed the time taken to drain mobile battery while continue capturing pictures and having camera applications on at the same time then how much average storage thus an image occupies in free memory after capturing and processing the image. Based on the output and observations we have discussed and presented our conclusion.*

KEYWORDS — ANDROID, BATTERY LIFE, CAMERA, MEMORY, MEGAPIXEL, SMARTPHONES, STORAGE.

I. INTRODUCTION

Today the number of smart-phone users is expected to be around 3 billion and is predicted to grow further by several million in the next decades. It empowers users with Internet access, music, audio, images, videos playback & recording, navigation and communication applications. Thanks to the random development & implementation of wireless technologies, smart-phones allows users to be reach anywhere at any time and makes life easy. A common complaint of many users is its miserable battery life. Charging smartphones after a single day of moderate usage is unacceptable for many users. Hence, we are motivated to investigate the direct impact of smartphone camera on total battery and storage consumption.

The world had massive growth in terms of mobile Cameras Development. Over the last couple of years, the usage of mobile Camera technology has increased tremendously. Mobile phones are also becoming an crucial part of the day to day lifestyle, with the use of mobile cameras to capture clinically relevant images. We witnessed that mobile devices are becoming a significant part of our lives. At the same time, we are also seeing the creativity and the dynamics of mobile photography—today's generation using mobile cameras to explore their photography skills.

Previously most of the Researchers have done the research. Still, with different perspectives, some goals where to find the application effects on the battery, whereas some research was only related to the camera megapixels. According to Chunk Martin article on Nov 5, 2019 majority, 77% of the customers recognize battery life as the most desired feature in smartphones, followed by Storage Capacity (65%), camera Image quality (62%) and screen resolution & size (48%).

The purpose of the research is to observe & calculate what impact does mobile camera has on its battery and Storage as well. This research can help to understand how much battery and Storage are sufficient in mobile concerning the camera.

In this research, we had observed various mobiles and their front as well as the back camera. We calculated how much time; thus, it takes to consume a specific amount of battery, and what average amount of space it considers in its memory. There is a wide range of camera applications available in the online market, but we had used the default camera—applications at default settings. Building a mobile with a better camera and battery life is got in trending in today's mobile market. Nowadays, users prefer better cameras in their smartphones, but the increase in camera quality will increase in battery consumption and memory as well.

II. RESEARCH OBJECTIVE

1) **Objective 1:** Observe the effects of Mobile camera on its battery.
2) **Objective 2:** Observe the amount of memory consumed after image is processed and stored in the memory.
3) **Objective 3:** How does different Camera Resolutions (Megapixels) gives the different result.
4) **Objective 4:** make the analysis on the bases of gathered data and come up with an conclusion.

III. LITERATURE REVIEW

According to the research work in “Power Consumption Analysis, Measurement, Management, and Issues: A State-of-the-Art Review of Smartphone Battery and Energy Usage ” by Pijush Kanti Dutta Pramanik Published in the year December 10, 2019, This research work gives a generalized, but brief analysis of the power utilization causes of a smart-phone and also offers effective measures to minimize the utilization for each factor. The important conclusion of this paper is based on four comprehensive points:

(i) Smart-phone’s power utilization assessment and estimation (includes power utilization analysis and designing)
(ii) power utilization management for smart-phones (including power saving methods and approaches)
(iii) state-of-the-art of the research and commercialized developments of smart-phone batteries (including another power sources)
(iv) mitigating the hazardous issues of smart-phones’ batteries (with a brief explanation of the problems).

According to the research work in “Users and Batteries: Interactions and adaptive energy management in mobile

systems" by Nilanjan Banerjee in the year May 30 2014. They had presented the results of an extensive trace collection and a user study that provides a first glimpse into the battery use and recharge behaviour of mobile systems, in particular laptops and mobile phones. They have made three critical observations in three comprehensive user studies:

(i) Many users frequently leave excess energy in the battery when recharging devices.

(ii) Charging behaviour is more often than not driven by opportunity, context, and conservative practice, rather than low battery conditions

(iii) Significant variations occur across mobile users and systems.

Based on these three observations, They have created an adaptive energy management system, named Llama that can scale energy usage to user behaviour, probabilistically matching energy consumption with the expected recharge time. They have deployed this tool on several laptops and Smart-phones and received generally positive feedback.

The Research Work "Energy Consumption in Smartphones: An Investigation of Battery and Energy Consumption of Media Related Applications on Android Smartphones " published by John Elliot in Year 21 September 2017 targets to offer caring advice to the public regarding manufacturer specifications and standard practices among smartphone owners that can help world-wide to Reduce to GHG (greenhouse gas) emissions. The important objective is also to understand the Critically factors affecting smartphone battery energy consumption.

The Research Work "What is Eating up Battery life on Smartphone: A case study " published by Grace Metri et al. [3] in year 2012 has described how background task or application affects the battery life and consequently how to improve it. The study specified specified how energy consumption varies depending on the background applications and network connection.

IV. METHODOLOGY

This research work uses a quantitative research method applied to data collected from experiments performed on different mobile phones. The study has carried out observing cameras of smartphones by obtaining details like number of cameras in front as well as back and also their megapixels. We have calculated the effect of the camera on storage and full battery consumption. First, we did a small observation that in how much time 2% battery is consumed by clicking photos continuously at default settings and how much storage it consumed for those photos. After doing this, we got an idea of how much time, storage, and pictures are clicked in 2% battery drain out.

We performed this experiment on the various mobile phone of different brands having different camera Resolution (Megapixels). To collect the observed results, we stored it in to the Google sheets. After obtaining all the results from the various mobile phones, we calculated the average Time for total battery consumption, Average total number of pictures which can be captured in that Time, and average space which will be occupied in the storage. For calculating all this, we used standard mathematical methods. For creating the data analysis graphs, we used the inbuild Google excel chart feature.

V. DATA ANALYSIS

The data has being collected from various smartphones available from our family members and friends. By doing a small experiment with all the phones we have tried to calculate the effect of the camera on storage as well as battery consumption of various smartphones. We can also say that the effect of cameras on smartphones is due to their megapixels.

Data interpretation:

On the basis of this small experiment we're able to calculate average total time in hours the battery will fully consumed and also how much storage the pictures will take of your smartphone due to different camera resolution

	B	C	D	E	F	G	H	I	J	K	L
1	Camera(Back / F	Mobile	mega pixel	No. Of Images	Time Taken(MI	Storage Size	Battery Consu	Battery Capacity	Average Total	Average Storage	Average Total No. Of Images
2	Back	Note 5 Pro	12-5	169	4:14:20	376.12	80	4000	3:31:50	18806	8450
3	Back	Samsung J7 prime	13	229	6:59:44	599	66	3300	5:49:12	29950	11450
4	Back	Redmi note 7 pro	48-5	105	3:05:58	508.3	80	4000	2:34:11	25415	5250
5	Back	Redmi Y3	12-2	127	4:11:13	336.62	80	4000	3:29:10	16831	6350
6	Back	OPPO F9 Pro	16-2	137	4:25.70	511.3	70	3500	3:40:52	25565	6850
7	Back	Redmi 7	12-2	108	4:13:23	403	80	4000	3:30:51	20150	5400
8	Back	Lenovo Tab-4	5	722	9:29:33	324.5	97	4850	7:54:02	16225	36100
9	Back	MI A3	48-8-2	163	5:24:35	285.2	80.6	4050	4:30:01	14260	8150
10	Back	Redmi note 8 pro	64-8-2-2	75	4:25:01	754	90	4500	3:40:49	37700	3750
11	Back	Note 5	12	106	4:51:48	420.52	80	4000	4:02:21	21026	5300
12	Back	XT1902-3 (K8 Note)	13-5	159	5:53:28	295.42	80	4000	4:54:10	14771	7950
13	Back	Panasonic P55	8	87	3:00:20	19.91	50	2500	2:30:01	995.5	4350
14	Back	Mi 5a	13	158	5:42:06	89	60	3000	4:45:00	4450	7900
15	Front	Redmi note 7 pro	13	138	4:10:08	851.2	80	4000	3:28:20	42560	6900
16	Front	OPPO F9 Pro	25	83	3:51:19	433.3	70	3500	3:12:30	21665	4150
17	Front	Redmi Y3	32	125	4:08:30	575.5	80	4000	3:26:40	28775	6250
18	Front	Samsung J7 prime	8	256	7:55:45	559	66	3300	6:35:52	27950	12800
19	Front	Note 5 Pro	20	201	4:54:19	1128.6	80	4000	4:04:59	56430	10050
20	Front	Redmi note 8 pro	20	102	4:48:36	389.92	90	4500	4:01:00	19496	5100
21	Front	Redmi 7	8	117	4:27:23	346.32	80	4000	3:42:31	17316	5850
22	Front	Lenovo Tab-4	2	734	9:46:57	130.88	97	4850	8:08:22	6544	36700
23	Front	Note 5	5	94	5:06:37	130.066	80	4000	4:15:01	6503.3	4700
24	Front	XT1902-3 (K8 Note)	13	165	5:44:10	353	80	4000	4:46:39	17650	8250
25	Front	MI A3	32	110	5:36:21	1105	80.6	4050	4:40:01	55250	5500
26	Front	S4	5	134	4:23:33	167	50	2500	3:39:10	8350	6700
27	Front	Mi 5a	5	169	4:58:37	79	60	3000	4:08:21	3950	8450

Fig 1.0 [Data Table]

VI. Observation Findings

- **Back Camera :**

Fig 1.1.1 Graph represented average total time in hours the mobile battery will drained out fully due to back camera is shown:

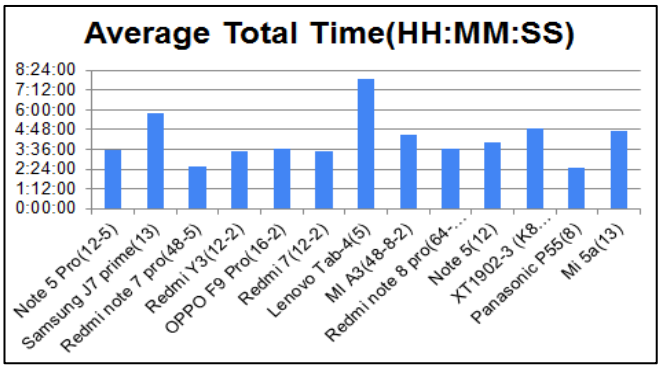

Fig 1.1.1 [Back-Average Total Time(HH:MM:SS)]

Lenovo Tab-4 has maximum average total time for battery consumption approximately (7:54:02) with 5 MP back camera and 4850 battery capacity whereas Panasonic P55 has 2:30:02 minimum average time for overall battery consumption with 8MP back camera and 2500 battery capacity.

Fig 1.1.2 Graph represented average storage size in MB consume for average number of images clicked with back camera until mobile Battery is fully consumed is shown:

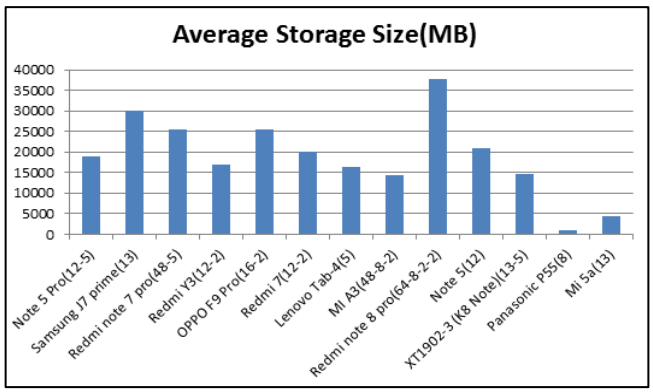

Fig 1.1.2 [Back-Average Storage Size(MB)]

Redmi note 8 pro requires the maximum storage size of approximately 37700 in MB for clicking pictures with 4 back cameras (64-8-8-2 MP). Panasonic P55 only consumes 995.5 MB for clicking images with 8 MP back camera.

Fig 1.1.3 Graph represented the Average number of images can be taken with back camera until full battery of smartphones is consumed is shown:

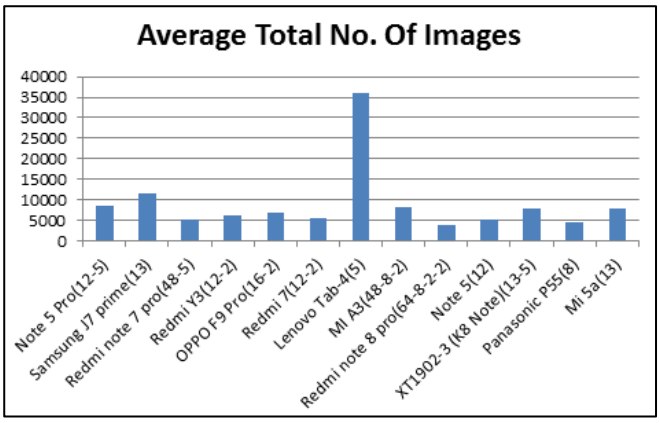

Fig 1.1.3 [Back-Average Total No. Of Images]

Lenovo Tab-4 can click maximum pictures up to 36500 until full battery is consume, since its battery capacity is about 4850 and its back camera is of 5MP whereas Redmi note 8 pro is able to click only 3750 images till full battery consume, because it has 4 back Cameras of 64-8-2-2 MP.

- **Front:**

Fig 1.2.1 Graph represented average storage size in MB consume for average number of images clicked with front camera until mobile Battery is fully consumed is shown:

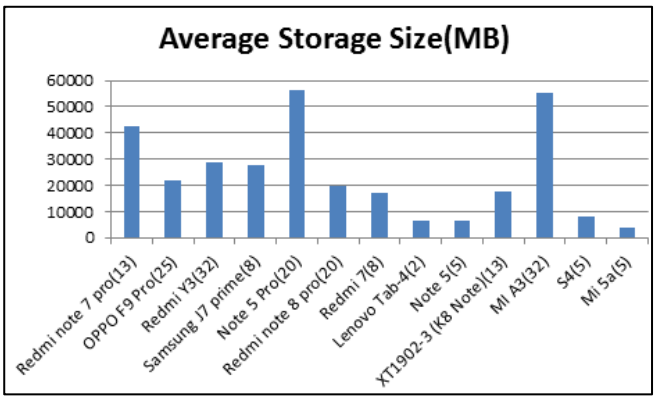

Fig 1.1.1 [Front-Average Storage Size(MB)]

Note 5 pro requires the maximum storage size of approximately 56430 in MB for clicking pictures with font camera of 20 MP. Mi 5a only consumes 3950 MB for clicking images with 5 MP front camera.

Fig 1.2.2 Graph represented average total time in hours the mobile battery will drained out fully due to front camera is shown:

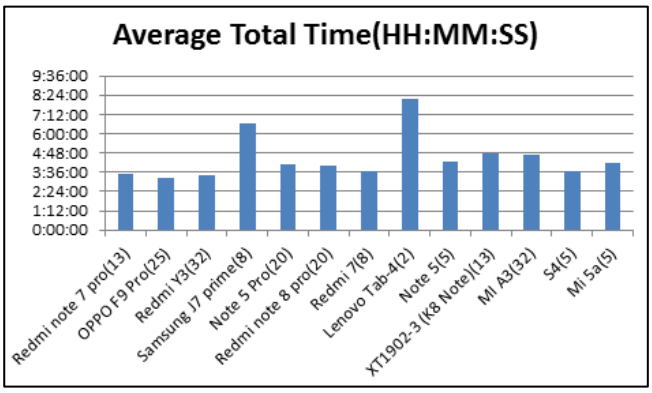

Fig 1.2.2 [Front-Average Total Time(HH:MM:SS)]

Lenovo Tab-4 has maximum average total time for battery consumption approximately (8:08:22) with 2 MP back camera and 4850 battery capacity whereas OPPO F9 pro has 3:12:30 minimum average time for overall battery consumption with 25MP front camera and 3500 battery capacity.

Fig 1.2.3 Graph represented the Average number of images can be taken with front camera until full battery of smartphones is consumed is shown:

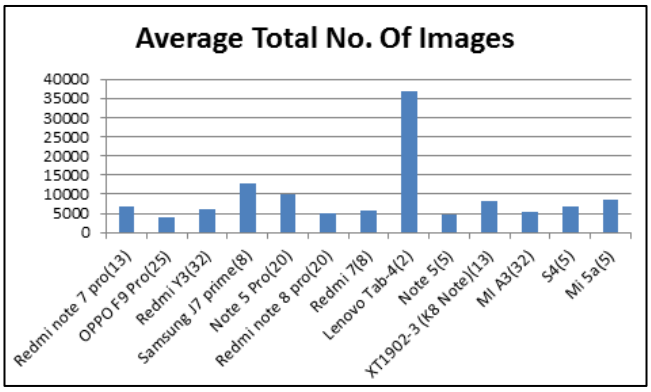

Fig 1.1.3 [Front-Average Total No. Of Images]

Lenovo Tab-4 can click maximum pictures up to 36700 until full battery is consume, since its battery capacity is about 4850 and its front camera is of 2MP whereas OPPO F9 pro is able to click only 4150 images until full battery is consume, because it has front camera of 25MP.

VII. Conclusion

results, we came to the conclusion that mostly higher the camera resolution more the battery will be consumed and high the camera resolution more image file size. With High camera resolution (Megapixels) the image processing becomes more complex, which gives process load on the processor, which directly or indirectly results in more battery consumption. As the camera resolution gets higher, it captures a more defined image, that's why the image file size also increases and consumes more space in the storage. We can also see that because of higher camera resolution Smartphones with good battery life are affected resulting in full battery consumption in very few hours.

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