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Ad Tracking: Advertisement Tracking using Graphics Processing Unit

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Abstract:
Introduction: In this era of electronics communication, companies typically rely on the electronic media for marketing and advertisement campaigns to reach a broad audience. However, they have to bear a very high cost. The challenge through electronic media advertisement is transparent pricing. Advertisers require a mechanism to avoid extra payment. There exists different advertisement tracking software's which is expensive and requires substantial processing power. **Methodology:** In this research, an effective ad tracking software architecture is proposed using graphics processing unit to achieve better performance. This system will guaranty the accurate pricing of advertisement by calculating the exact amount of time slot for which the advertisement was on-air. **Result & Conclusion:** The proposed system provides an efficient and cost-effective solution for advertisement tracking. In a nutshell, it is concluded that advertisement through electronic media is a primary concern in these days and the proposed system will help companies transparent and accurate pricing.
Keywords- Video, GPU, Advertisement, Kernel, Frame, Image Processing.

1. Introduction

Advertisement plays a pivotal role in the growth and promotion of any business economy. Advertising can positively affect the sales. Companies use a different kind of sources for the advancement of their business. Electronic media is considered the best source of the advertisement [1]. The reason is to attract large audience within a short time. They can convey their messages about their product type and quality with the help of manipulated videos on electronic media. However, large advertisement expenditure is a critical factor [2].

The advertising has become a multi-billionaire business. Business companies hire the services of advertising companies for commercial.

In developing countries, there is no proper tracking mechanism. There were some software's which scan the audio of the announcement for costing. However, one other method was just for ads that contain music or sound. The ads that don't have the music like logo or scroll are not logged in by digitally playing the video and just scanning its audio. In this way, the only video clip has recorded no logo and scroll is logged by this method. These were reviewed manually.

They can convey their messages about their product type and quality with the help of manipulated videos on electronic media. However, the extraordinary cost is the major barrier. Every business firm must pay the different amount in term of money to broadcast their advertisement videos on electronic media. But it is tough for the businessman to keep track of their due amount regarding publication cost. So, the tracking mechanism is dire need of advertisers to avoid payment of extra money. There is different ad tracking software available in the market to keep the tracking procedure but they are too much expensive, and massive processing power is required

for these to operate. In this work, an advertisement tracking software is developed which uses the computational power of graphic processing unit and intelligently keeps track of all advertisements with the magnitude speedup when compared with serial version. This designed system is characteristically remaining vigilant and keep 100 percent the accurate result of publicity campaigns played on electronic media. So, by using this software, the advertiser must pay only for their original time slot per ad size instead of different hidden charges due to the systems mistake. We have used graphics processing unit to improve the performance of the system and found it quite accurate and transparent.

But high cost is the major hurdle. The advertising agencies charges from the companies for their advertisements on electronic media per their advertisement duration size. Sometimes these advertising agencies charge hidden costs from their clients. However, it is tough for the businessman to keep track of their payments. There should be an accurate tracking mechanism to avoid the extra fees. Different advertisement tracking software's are available in the market but they are much expensive and significant processing power is required and only used by the satellite channels. In this work, an advertisement tracking software is developed which uses the computational power of graphic processing unit and intelligently keep track of all advertisements with the magnitude speedup when compared with serial version. This designed system characteristically remains vigilant and keep more than ninety percent accuracy of the played clips. So, the proposed system is practical and convenient for the industry. The proposed system will let the user play the video and get the snapshots of the advertisements. This system will keep all the track of the videos played by maintaining a database, and proper reporting facility is provided.

Companies pay for advertising agencies for promotion of the products on different channels. The advertisement agencies charge the companies based on ad duration. In the current system, recordings of various channels are executed in a serial manner.

The rest of the article is organized in different sections. Section II gives a brief overview of the contribution of this research. Section III presents the GPU programming model. In section IV, we will explain the current system architecture. Section V presents the methodology and proposed system architecture. In the end, we conclude with the discussion about the proposed work.

2. Related Work

Video tracking was very rare in its early age, but it was matured with the passage of time when its importance was realized in different perspectives. Video monitoring was useful for the surveillance and security purposes. But now a day's video based tracking is also very helpful for the advertisement tracking for the billing purpose.

SudiptaN.Sinha1 delineated here in this paper examination and coordinating of 2D components point is imperative in the recordings to while contrasting like item discovering, affirmation, arrangement acknowledgment and making less opened assurance. While guaranteed back to back occupations a similar setup from the movement for video [3] requires online element point following, others need components to be separated and coordinated crosswise over edges isolates in time. Illustrations Processing Unit has been growing quicker than Central Processing Unit, a fashion estimated to continue in the close-by forward coming [4].

Paul Brasnett, in this paper, depicts that they inspect object following in video orders by spending the looming of component filtering to course structures from video outlines. In his work, they have built up a molecule channel (PF), and Gaussian aggregate particle channel (GSPF) which depend on various data related signs, particularly shading and surface, and have been characterized with extraordinarily nonlinear models. The calculations depend

on prospect factorization as a formation of the possibilities of the clues. They validate the rewards of seeking after with many liberated corresponding hints associated with following with discrete signs. The advantages are enlarged toughness and enhanced correctness. The presentation of the two-fold filter is examined and legalized above both counterfeit and standard video structures [5].

Sudipta N. Sinha plan this paper one of a kind executions of the KLT highlight following and SIFT highlight deliberation calculation that ride on the GPU and it fits for video examination in simultaneous disclosure frameworks. Although earth shattering quickening over standard CPU operations is accomplished by controlling parallelism conveyed by new programmable representation equipment, the CPU is self-sufficient alert to ride further calculations in identical. Other than this Graphics Processing Unit-based KLT execution trajectories almost a thousand components in immediate which is a twenty times perfection than the CPU. The GPU-situated SIFT execution theoretical around 800 parts that is about ten times snappier than CPU performance [6].

Jun Yang depicts in this paper there are unique mixed media applications that can exploit the systems for acclimatizing present classifiers to information through different designations. To start with the case in regards to this is cross-area video origination acknowledgment that reasons to adjust thought classifiers through a few video domains. In this paper, they find two urgent entanglements for classifier update: (1) in what way, transmute present classifier(s) into an effective classifier for a crisp dataset which merely has a restricted figure of sorted cases, and (2) how, decision the greatest prevailing classifier (s) for amendment. [7].

Emanuele Trucco and Konstantinos Plakas in this paper addresses video-tracking, the issue of taking after moving targets consequently over a video grouping, and brings three fundamental commitments. To start with, they gave a short prologue to video tracking in PC vision, including plan prerequisites and a survey of late systems, with a few points of interest of chose calculations. Second, they gave a diagram of 28 new papers on subsea video-tracking and related movement investigation issues, apparently catching the best in the class of subsea video-tracking. We abridge key components in a similar, initially table, and talk about this work in contrast with the best in class in PC vision. Third, we distinguish well-demonstrated PC vision procedures not yet grasped by the subsea research group, proposing helpful exploration headings for the subsea video preparing group [8].

Benjamin Coifman in this paper presents about expanding blockage on interstates and issues connected with existing indicators have brought forth an enthusiasm for new vehicle identification innovations, for example, video picture preparing. Existing business image handling frameworks function admirably in free owing activity. However, the structures experience issues with a clog, shadows, and lighting moves. These problems stem from vehicles somewhat blocking each other and the way that cars show up distinctively under different lighting conditions. We are building up an element based following framework for recognizing vehicles under these testing conditions. Rather than following whole cars, vehicle details are supported to make the framework hearty to incomplete impediment. The framework is entirely useful under changing lighting conditions because the most striking components at the given minute are followed. After the elements leave the next locale, they are assembled into discrete vehicles utilizing a typical movement limitation [9].

Zhu Liu and Yao Wang show in this paper face location and following are critical in video content examination since the most relevant articles in the majority of the videos are people. This article proposes another methodology for joined face location and following in video. The face identification calculation is a quick format coordinating system utilizing iterative element programming. Although the face identification calculation is

intended for frontal face, the same instrument can likewise be connected to track non-frontal appearances with online adjusted face models. Because of the embodiment of format coordinating, the calculation is equipped for looking at the comparability among various confronts, which makes it reasonable for following the same face that happens at incoherent worldly areas in the video. While the proposed face discovery technique gives equivalent exactness as the neural system based methodology, it is much quicker [10].

Paul Brasnett, Lyudmila Mihaylova, Nishan Canagarajah and David Bull delineate in this paper that they research object following in video groupings by utilizing the capability of molecule filtering to process highlights from video outlines. A particle filter (PF) and a Gaussian aggregate particle filter (GSPF) are created based upon numerous data signs, to be perfect shading and composition, which are depicted with very nonlinear models. The calculations depend on probability factorization because of the probabilities of the signals. We show the benefits of following with different autonomous integral signals contrasted with following with own prompts. The focal points are expanded strength and enhanced precision. The execution of the two filters is researched and approved over both manufactured and conventional video arrangements [11].

Lie Lu, Hong-Jiang Zhang addresses in this paper the issue of permanent speaker change identification and speaker following in communicated news video examination. In such a case, both speaker personalities and number of speakers are accepted obscure. A two-stage speaker changes recognition calculation, including possible change discovery and refinement, is proposed. Speaker following is performed given the aftereffects of speaker change identification. A Bayesian Fusion strategy is utilized to intertwine different sound components to get a more reliable result. The calculation has low unpredictability and keeps running progressively with an extremely constrained postponement in the examination. Our analyses demonstrate that the calculations create exceptionally tasteful results [12].

Pierre F. Gabriel, Jacques G. Verly, Justus H. Piater, and André Genon present an audit of existing procedures and frameworks for following different blocking objects utilizing one or more cameras as a part of this paper. Taking a definition of the impediment issue, they partition these methods into two gatherings: merge split (MS) methodologies and straight-through (ST) approaches. At that point, they consider following in ball game applications, with accentuation on soccer. Considering this evaluation of the cutting edge, they recognize what have all the earmarks of being the most encouraging methodologies for following all in all and for soccer specifically [13].

In [14] authors proposes a man distinguishing proof procedure that can perceive and check individuals from unconstrained video and sound. In this letter [15], authors portray an exact mistake following plan for stable transmission of continuous H.263 video is displayed. By using a criticism channel, the decoder reports the locations of undermined squares impelled by communication blunders back to the encoder. With these negative affirmations, the encoder can decisively compute and track the spread mistakes by looking at the retrogressive movement reliance for every pixel in the present encoding outline. With this exact following, the error proliferation impacts can be ended entirely by INTRA reviving the influenced large scale pieces. Moreover, by using the four-corner following guess and the linear movement demonstrate, a quick calculation is additionally created to facilitate lessen the calculation and memory necessities. The reproductions show that both plans yield critical video quality upgrades in blunder inclined situations. The upsides of the little memory prerequisite and the little calculation many-sided quality are exceptionally reasonable for continuous execution [15].

Dominik A. Klein, Dirk Schulz, Simone Frintrop, and Armin B. Cremers said that in this paper, we display a visual item tracker for versatile frameworks that can practice to individual articles amid following. The center of our technique is a novel perception model and the way it is naturally adjusted to a changing article and foundation appearance after some time. The model is incorporated into the evidently understood Condensation calculation (SIR filter) for actual derivation, and it comprises of a helped troupe of primary edge classifiers based upon focus encompass Haar-like components, which the filter persistently overhauls considering the pictures saw. We display improvements and reasonable approximations to restrict the computational expenses. Along these lines, the final calculations are fit for preparing video contribution at constant. To tentatively research the addition of adjusting the perception model we contrast two unique methodologies and a non-adjusting adaptation of our perception model: keeping up a single perception model for all particles and keeping up accurate perception models for every molecule. What's more, trials were led to think about framework exhibitions between the proposed calculations and two other best in class Condensation-based following methodologies [16].

Jinqiao Wang, Lingyu Duanetc delineates that most communicate stations depend on TV logos to claim video content proprietorship or outwardly recognize the communication from the intruding on the business square. Identifying and following a television logo is essential to TV advertisement skipping applications and logo-based telecom surveillance (logo nonattendance joins abnormal sign). Pixel-wise contrast registering inside foreordained logo areas can't address semi-straightforward TV logos well for the mixing impact so a logo itself and in steady foundation pictures. Edge-based format coordinating is feeble for semi-straightforward ones when thin edges show up. In this paper, we introduce a stronger way to deal with identify and track TV logos in video streams on the premise of multi ghastly pictures inclination. Rather than single casing based discovery, our methodology makes utilization of the temporary connection of multiple continuous edges. Since it is difficult to portray logos of irregular shape physically, a versatile limit is connected to the angle picture in sub-pixel space to remove the logo cover. Television logo following is finally completed by coordinating them asked area with a known layout. A substantial correlation test has demonstrated our proposed calculation outperforms standard strategies, for example, outline distinction, only edge based side coordinating. Our test information set originates from a portion of TRECVID 2005 news corpus and a few Chinese TV channels with testing TV logos [17,18].News related videos establish an essential cause of material for tracing and verifying important occasions [19].

3. Contributions

In this research, we developed and accurate and efficient framework which will track advertisement automatically. In the context of this study, accuracy means transparent pricing. Efficiency can be attained using parallel architecture. This study addresses following research questions:

1. What is an efficient strategy to implement Ad Tracking on GPU?
2. How accuracy of Ad Tracking system is better than the existing systems.

4. Current System Architecture

The current system works by clipping a portion of video recording and process frames individually. It takes each frame one by one in a serial and processes each frame in its turn. It performs all operations on the first frame and then store the result into the database and then second and so on. These frames are matched to the running video, and relevant matched data is stored in a database for further processing, But all the process is being done in a series which is so much time-consuming. The downside is a significant amount of computation performed on CPU which impacts the performance mostly (Figure 3 and 4).

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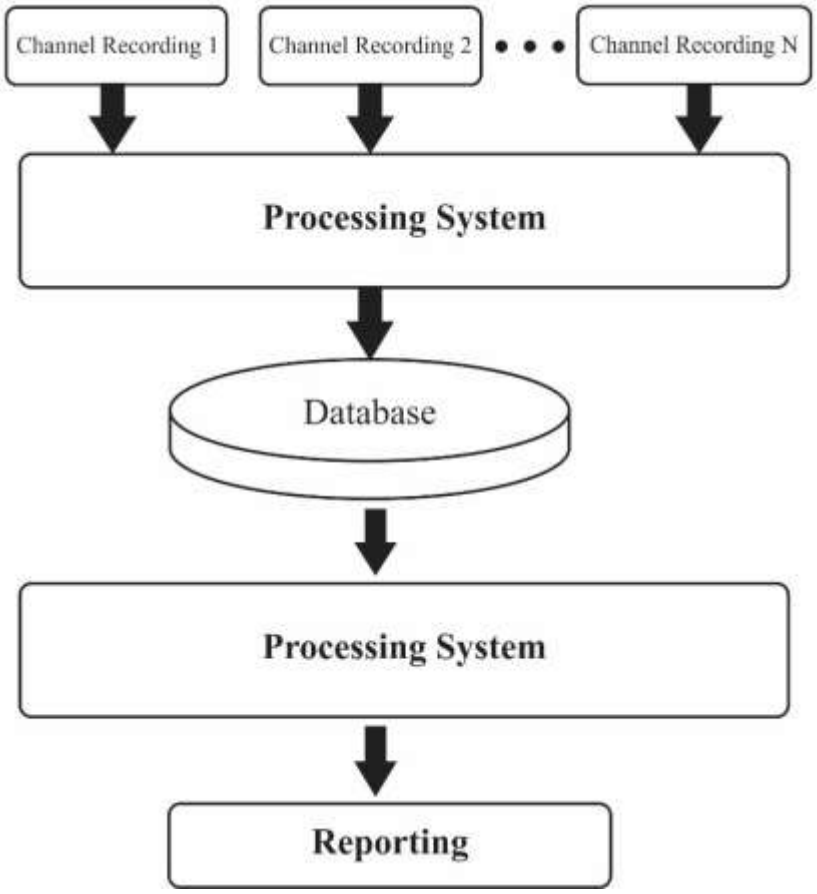

Figure 3: Existing System Architecture

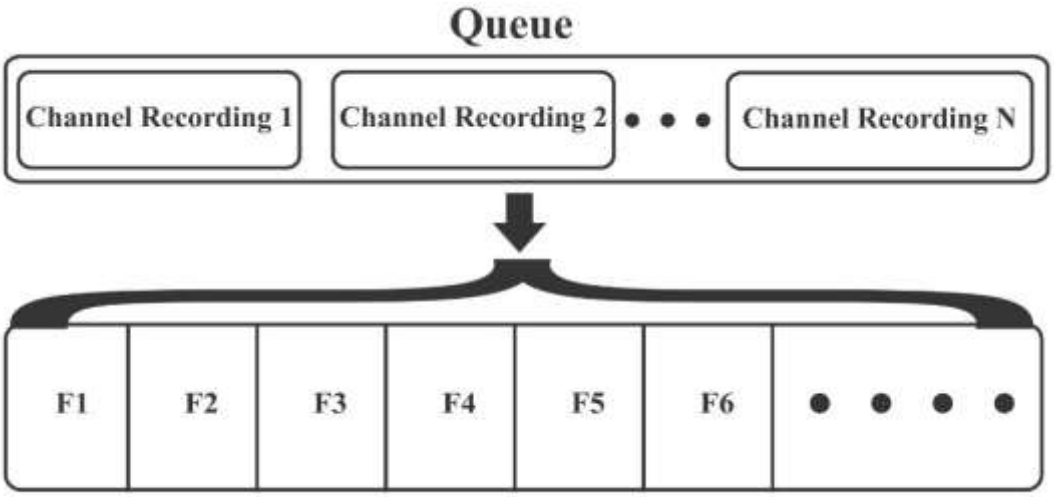

Figure 4: Existing Processing System Architecture

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We propose the efficient system architecture which calculates the accurate statistics about the advertisements. This system tackles the problem by benefiting the heterogeneous computing architecture. In heterogeneous computing, CPU and GPUs cooperate to solve the problem in an efficient manner. The proposed system has both task and data parallelism. This approach uses the mix of fine and coarse-grained methods. We have also used GPUs for billing system (Figure 5). In proposed system, we make snatches (snatch is a frame taken from any playable video advertisement). Each video is played per the planned sequence on its turn by matching its snatches. Each video is played with the rate 17 frames per second approximately. After every minute, all the frames (17f*60s) are calculated and given to GPU (Graphics Processing Unit), and then GPU takes these frames to its RAM for processing along with all snatches. GPU then process all the frames at the same time at once parallel instead of serial working. Then Graphics Processing Unit returns the results to Central Processing Unit (CPU) and CPU then process the results and saved into the database to generate different required reporting. This system with Graphics Processing Unit increases the performance of the system at 100% level along with 100% accuracy. This figure 5 shows the working of proposed system.

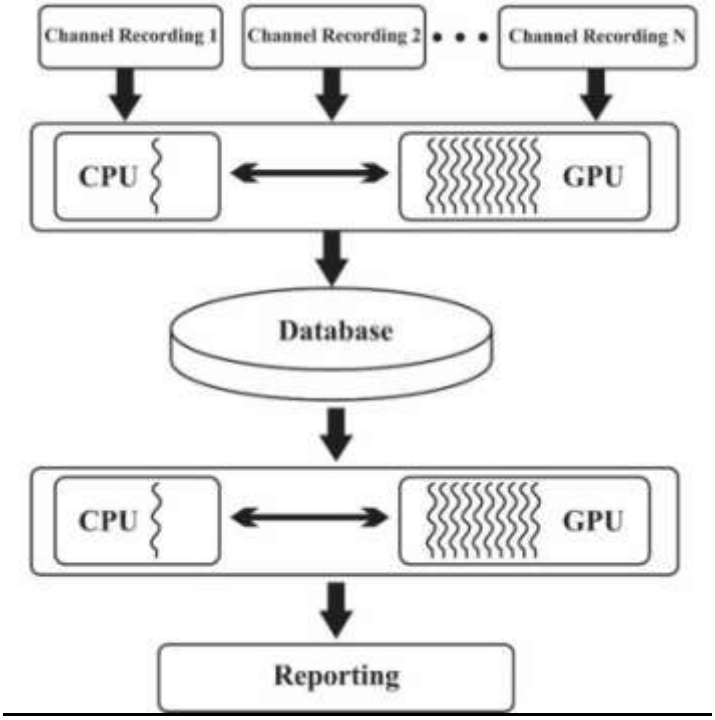

Figure 5: Proposed System Architecture

There can be many ways, but we considered three strategies to tackle this problem. (Fig 6) illustrates the first approach. We deal the kernels using this approach, and each core takes a channel recording and breaks that recording of each channel into frames. Then each frame is analyzed by multiple threads within a block. The main disadvantage of this strategy is N kernels will be executed. When a kernel is launched, the control will be transferred to the CPU each time that will result in wastage of time.

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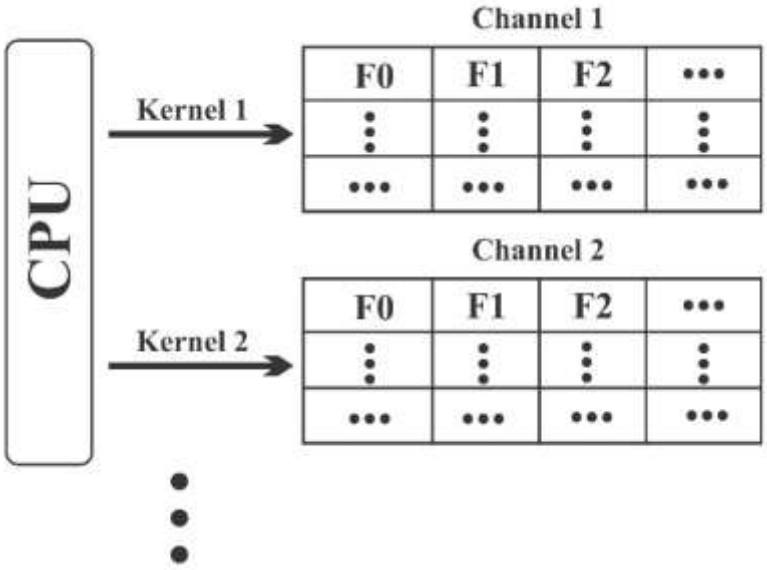

Figure 6: Proposed Strategy 1

In the second strategy (Figure 7), we have an only single kernel which is divided into different blocks and threads. Each block takes a channel recording and decomposes into frames. Each thread process one frame by applying image comparison. The advantage is multiple frames can be handled concurrently. This method uses coarse and fine grained approach. However, this strategy is lacking from scalability.

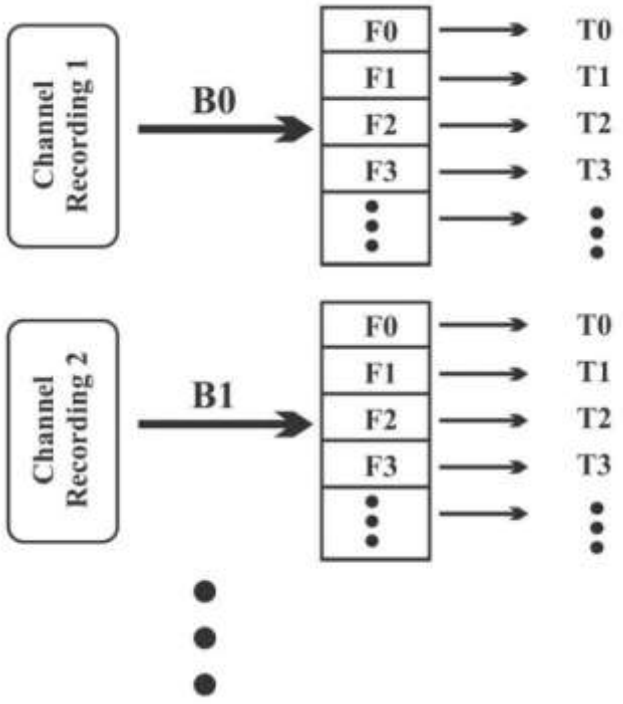

Figure 7: Proposed Strategy 2

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The new Kepler architecture empowers improved GPU consumption, streamline parallel platform strategy, and support in the arrangement of GPUs crosswise the variety of figure environs oscillating from workplaces to mainframes. Dynamic Parallelism enhances the competence for the GPU to produce fresh exertion for himself, coordinate on outcomes, and device the development of that exertion through committed, augmented hardware routes, all deprived of containing the CPU. Through if the tractability to adjust to the quantity and method of parallelism over the progression of a course's accomplishment, computer scientist can picture further speckled varieties of comparable graft and mark the maximum proficient usage the GPU as a division develops. This competence permits minus-organized, further compound jobs to route quietly and effectually, allowing greater slices of a submission to course utterly on the GPU. Furthermore, programs are informal to produce, and the CPU is unconstrained for further responsibilities. Hyper-Q permits many CPU cores to unveil slog on a single GPU concurrently, thus intensely cumulative GPU consumption and meaningfully sinking CPU indolent stints. Hyper-Q rises the whole amount of relations (work queues) among the base and the GK110 Graphics Processing Unit by letting 32 concurrent, hardware-accomplished associates (linked to the single link accessible with Fermi). Hyper-Q is a lithe explanation that permits distinct acquaintances from numerous CUDA streams, from various Message Passing Interface (MPI) methods or unfluctuating from multiple filaments inside a progression. Requests that formerly come across deceitful series crosswise responsibilities, thus preventive accomplished GPU consumption, can perceive up to histrionic recital proliferation deprived of varying any general code. Grid Management Unit - Permitting Dynamic Parallelism wants a successive, stretchy lattice administration and communication controller system. The new GK110 Grid Management Unit (GMU) manages and prioritizes grids to be executed on the GPU. The GMU can pause the dispatch of new grids and queue pending and suspended grids until they are ready to execute, providing the flexibility to enable powerful runtimes, such as Dynamic Parallelism. The GMU ensures both CPU- and GPU-generated workloads are properly managed and dispatched. New GPU Kepler architecture has dynamic parallelism feature [20]. By taking advantage of dynamic parallelism, we can launch multiple kernels within a core (Figure 8). In this manner, we can utilize hardware resources efficiently. CUDAfy comparison with the existing system for accuracy and efficiency [21].

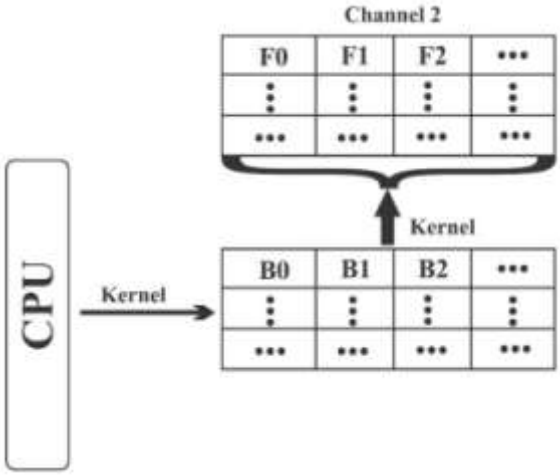

Figure 8: Proposed Strategy 3

5. Results and Discussions

This system is designed for the purpose to avoid the hidden charges paid by the advertisement companies. To avoid these hidden charges the system should keep hundred percent (100%) accuracy during calculation of time slot. Secondly, there should be efficiency in the system to calculate the time. Our ad tracking system which we design for GPU is fulfilling the requirements very efficiently and keeping track of that accuracy and efficiency of the system we design and web portal for all reporting. There are following reports available in this system to check out the precision and effectiveness.

Figure 9 is the main dashboard of the web portal which shows the total brands available at this system, complete categories/industry verticals, entire companies and overall advertisement tracking available at the system currently. After that brands wise, category wise and business wise graphical view of the weekly top ten companies overview chart is available at the portal which helps us to groups the top ten running advertisements with our system. Thirdly, all brand's total TVC spots and airtime of last 14 days and channel wise total spots and airtime report is also entitled at the dashboard of this web portal.

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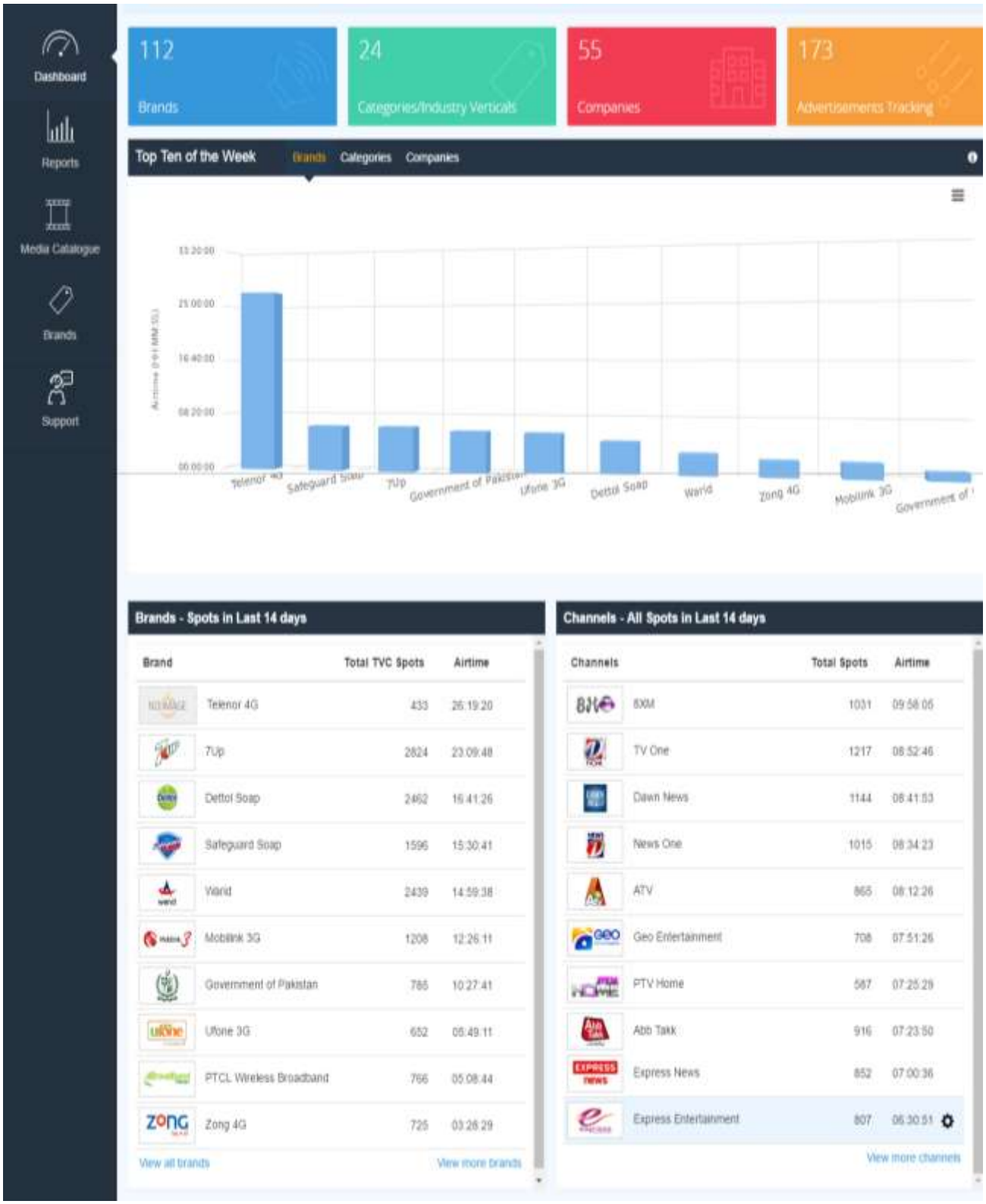

Figure 9: Dashboard of the Web

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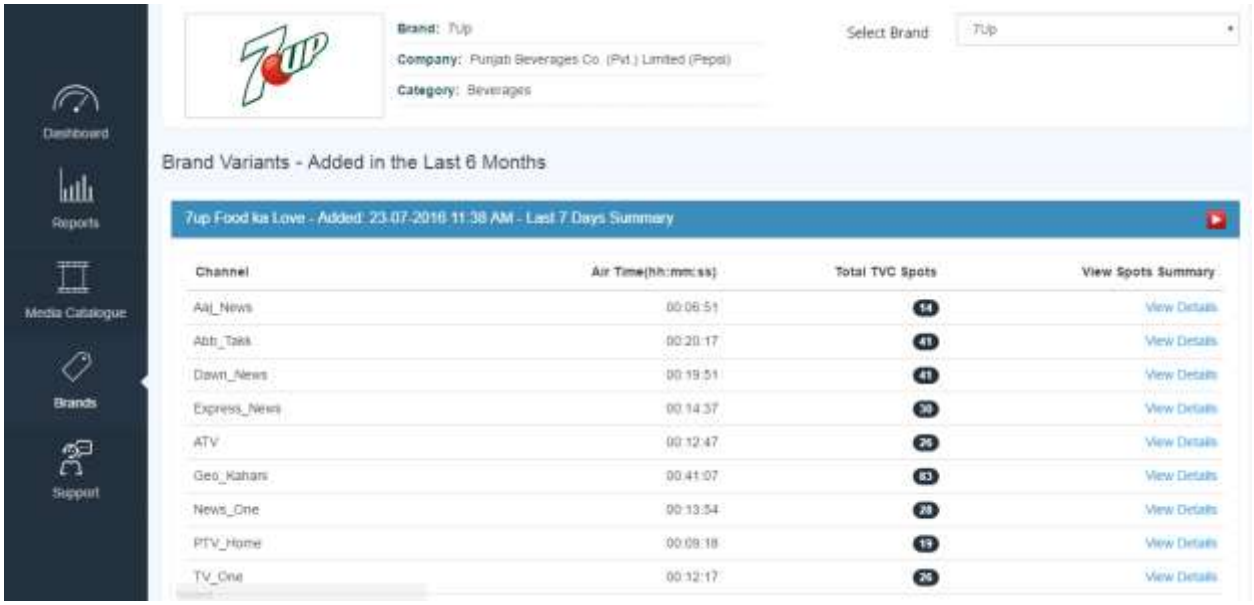

Figure 10: Brand Variants

Figure 10 shows brand variant information which is added into this system. Here we have the facility to select any specific brand and can get a summary of last seven days. It shows us that on which channels the advertisement of the chosen company is played and if differentiate in details the air time of that ad at each channel one by one their total TVC spots played and summary particulars of all spots can also be visualized at this portal. So, in the same way, we can select any brand from our list and check out their airtime and TVC spots detail regarding each channel separately.

Figure 11: Spot Summary Tabular View

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The figure 11 shows the detailed summary played spots of advertisement of one company at one channel date-wise. Here we can choose about duration that for how many days we need that report, and we want graph view or list view both display types are available in this system.

Figure 12: Category Wise Graphical View

Here figure 12 shows us that we can divide our customers into categories i.e. how many customers are related to Government, Beverages, Skin Care or Telecommunication, etc. This helps us to identify the category wise percentage of companies.

Figure 13: Companies Wise Graphical View Report

Figure 13 gives us the report of top ten companies' having maximum airtime in the last week. In this report, we can easily monitor and analyses that which company is generating maximum business for us.

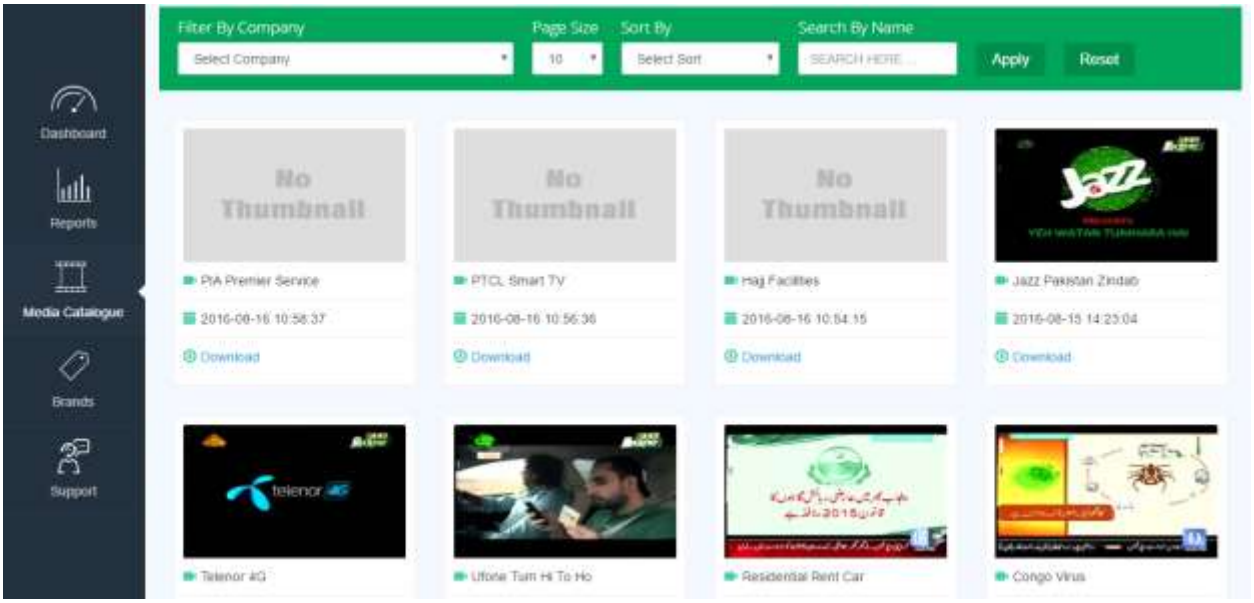

Figure 14: Media Catalogue

This figure 14 is about media catalog available on this portal. All the advertisements that we are playing on our system are present in our media directory. We can search this catalog by the name of the ad. We can filter our search by company name which can be sort by ascending and descending orders with some ads per page to display.

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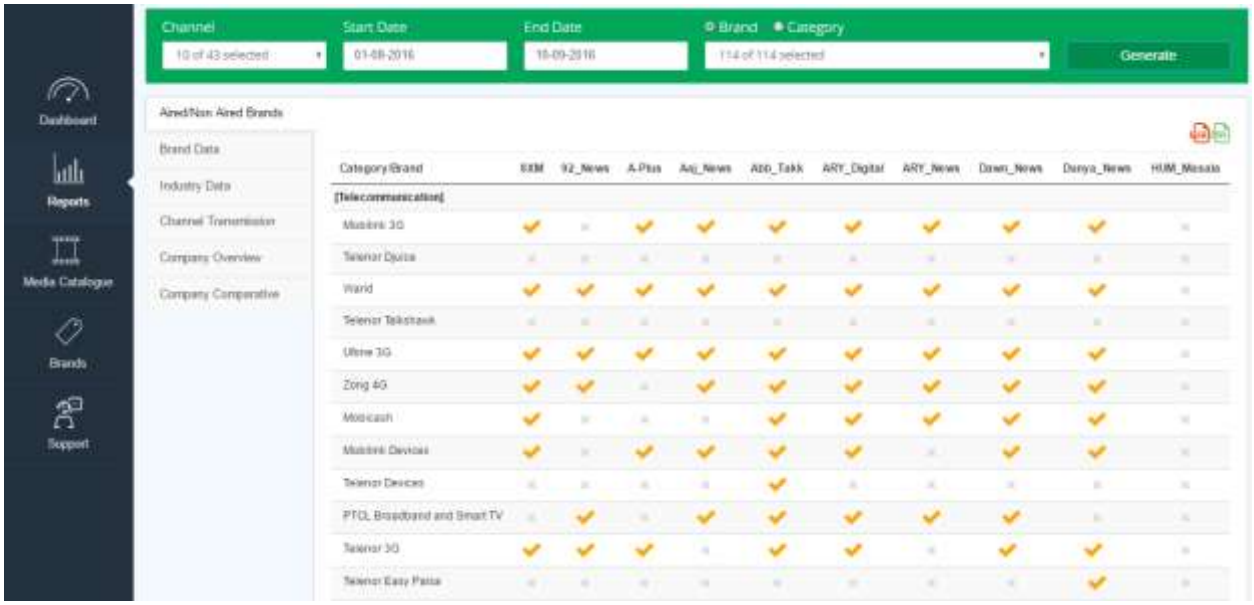

Figure 15: Aired/Non-Aired Brand Wise

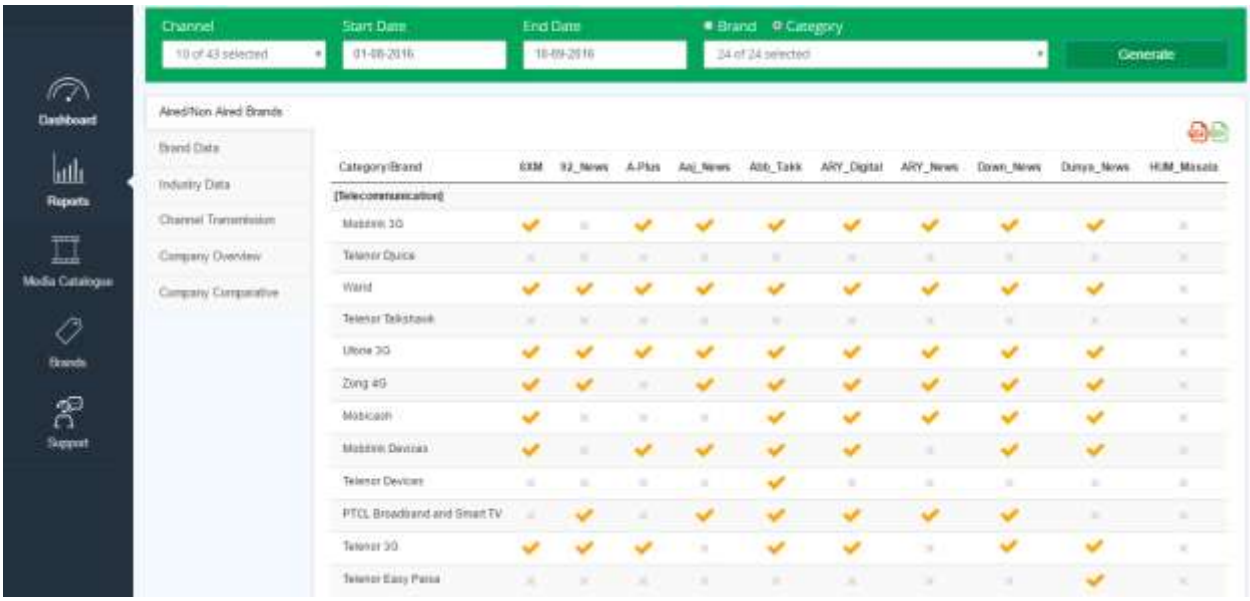

Figure 16: Aired/Non-Aired Category Wise

The figures 15 and 16 are related to the reports which help TV Channels to find out about the brands which are not aired on their channels but are aired on competitive channels. Companies / Brands can capture the channel information where their own brand and competitive brands are being aired, and respectively the channels where they need to invest in. This report can be generated brand wise and category wise as well.

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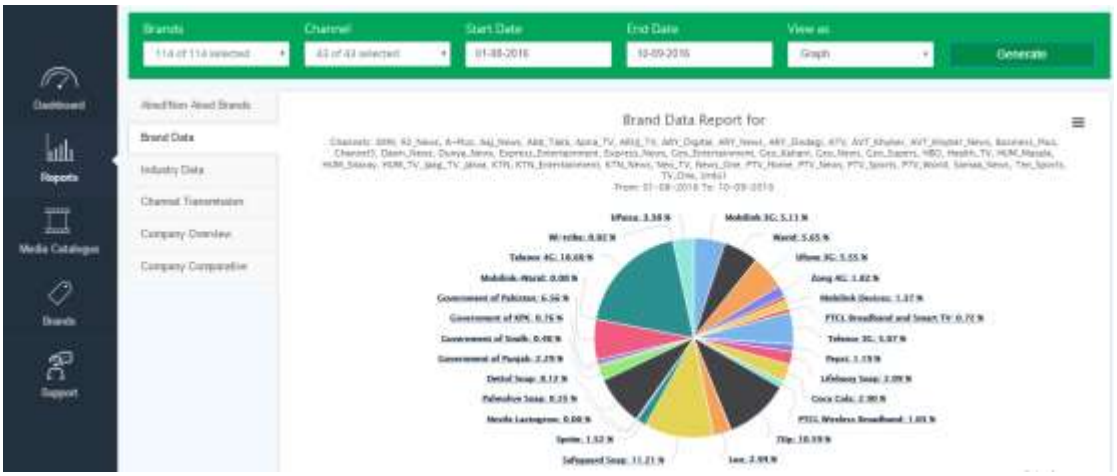

Figure 17: Brand Wise Data Report

Figure 17 shows us the report of brand data that shows the overall status of the company's brands broadcasted content. It covers the situation of the company and their brands over a span of time. The outcome of this report gives deep insight to audit the subscription plan. Users can calculate the difference between the scheduled on-air times against the executed content. Here we can make a selection of brands name, channels where the advertisement is played and we can take a report of a particular time span by selecting a start date and end date. The report can be displayed in graph view and list view both styles, and in this report, it shows us the total air time of each company in percentage in respective to each other.

Figure 18: Industry Data Report

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Figure 18 shows us the report about the comprehensive data of the industry verticals. The data in this report gives an overall analysis of industry vertical(s) spread over the selected list of channels. The end user can extract the sector trends from this report on selected channels and a date range. Competitive industry data could also be drawn from the same report.

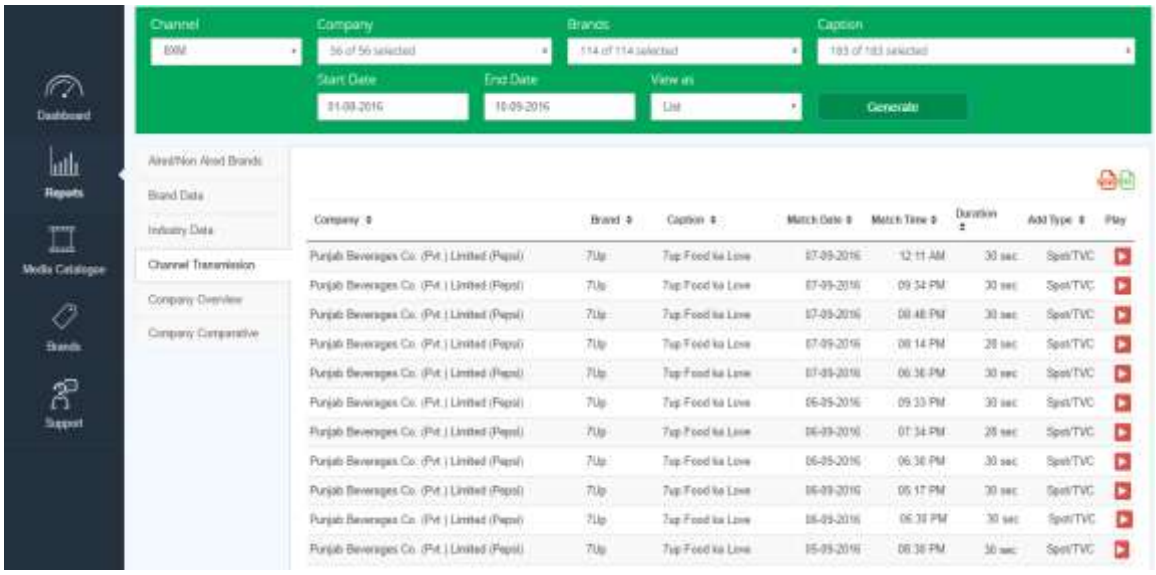

Figure 19: Channel Transmission Tabular View

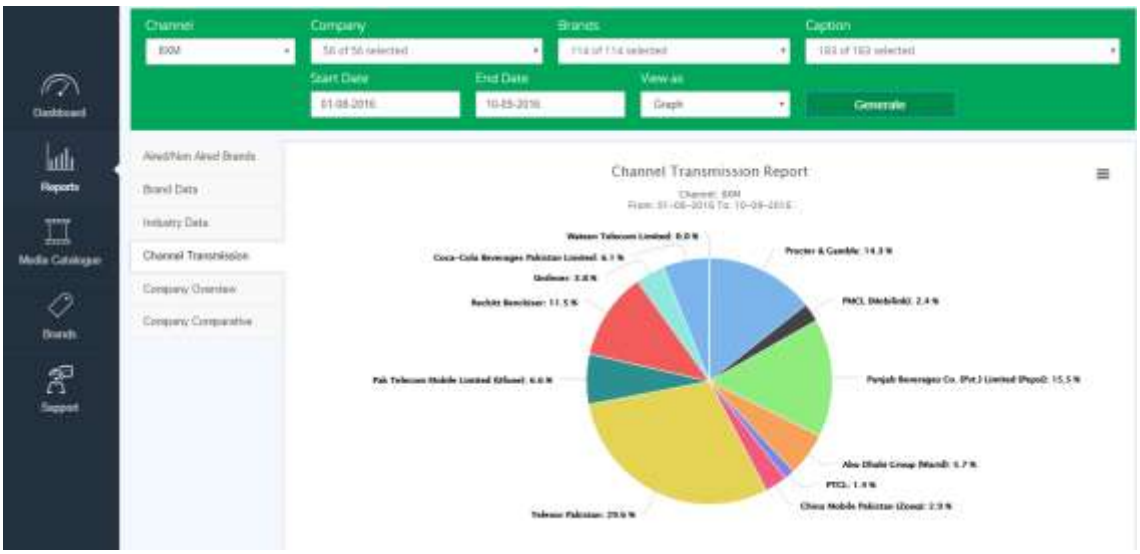

Figure 20: Channel Transmission Report Graphical View

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The figures 19 and 20 are showing us the reports used to display the complete spot by spot advertisement data of a subscribed channel date wise. The report acts as a confirmation on whether the commercials are aired accordingly, and thus are useful for audit/invoice clearance. Here we can generate both graphs based and list-based view of the report. It also supports us to download the pdf and CSV reports for further analysis as shown above.

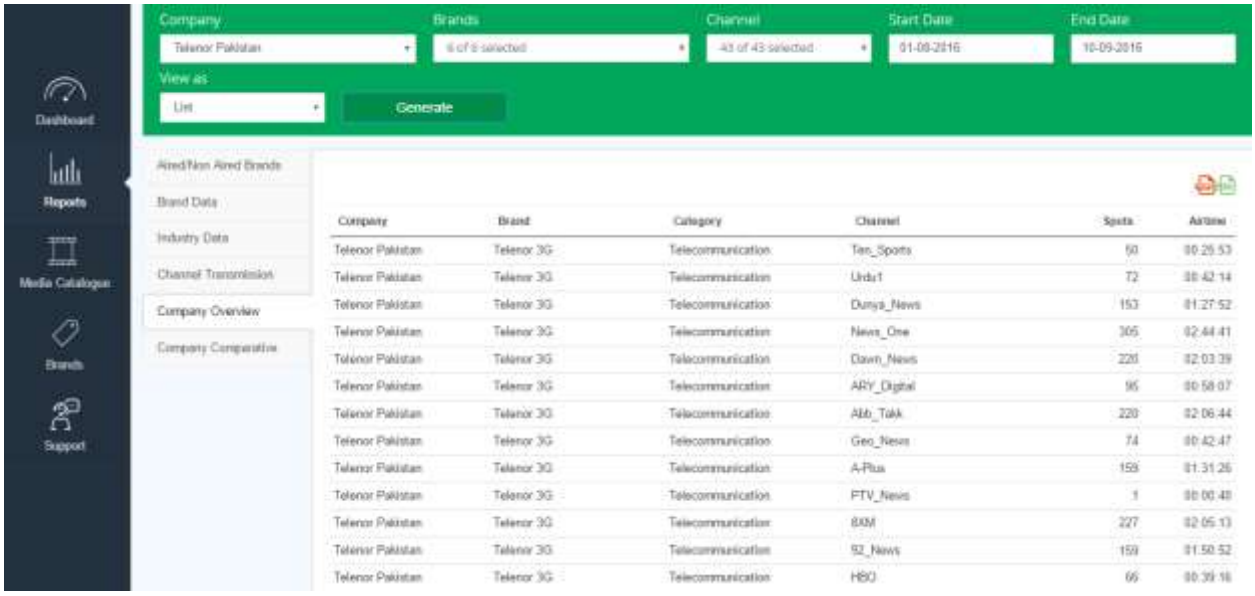

Figure 21: Companies Overview Report Tabular View

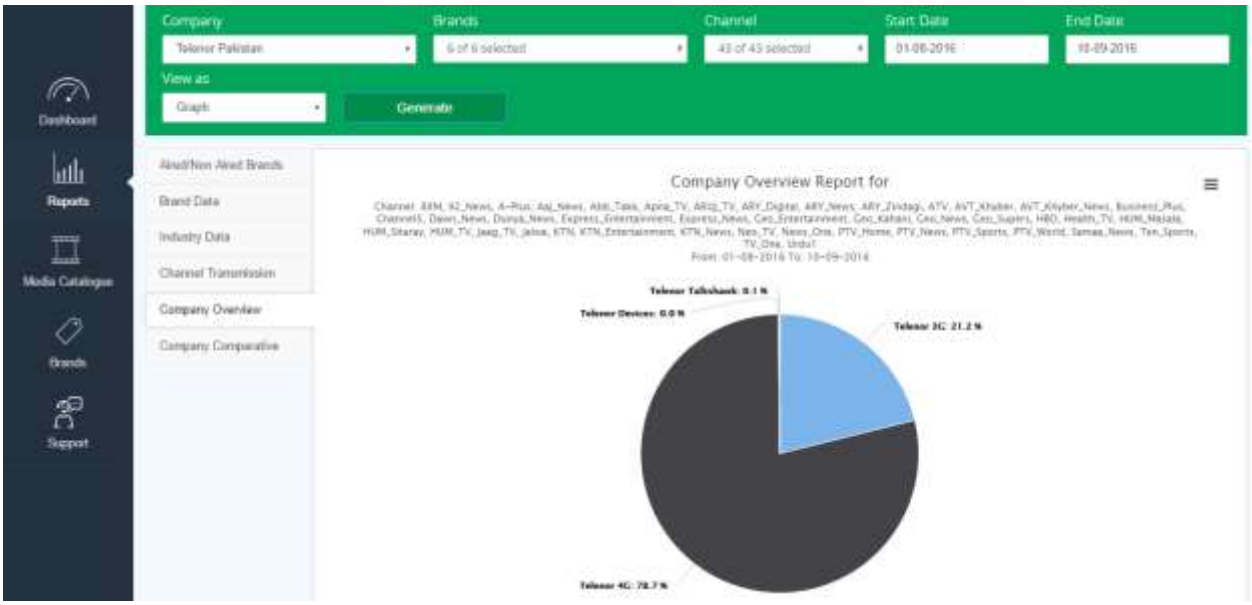

Figure 22: Companies Overview Report Graphical View

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The reports in number 21 and 22 give us an overall picture of all brands of a company, including the frequency and airtime took by each brand. You can select the brands and channel and make a date wise reports. These reports can be in list view and map view. The list view reports can be downloaded in the pdf and CSV formats.

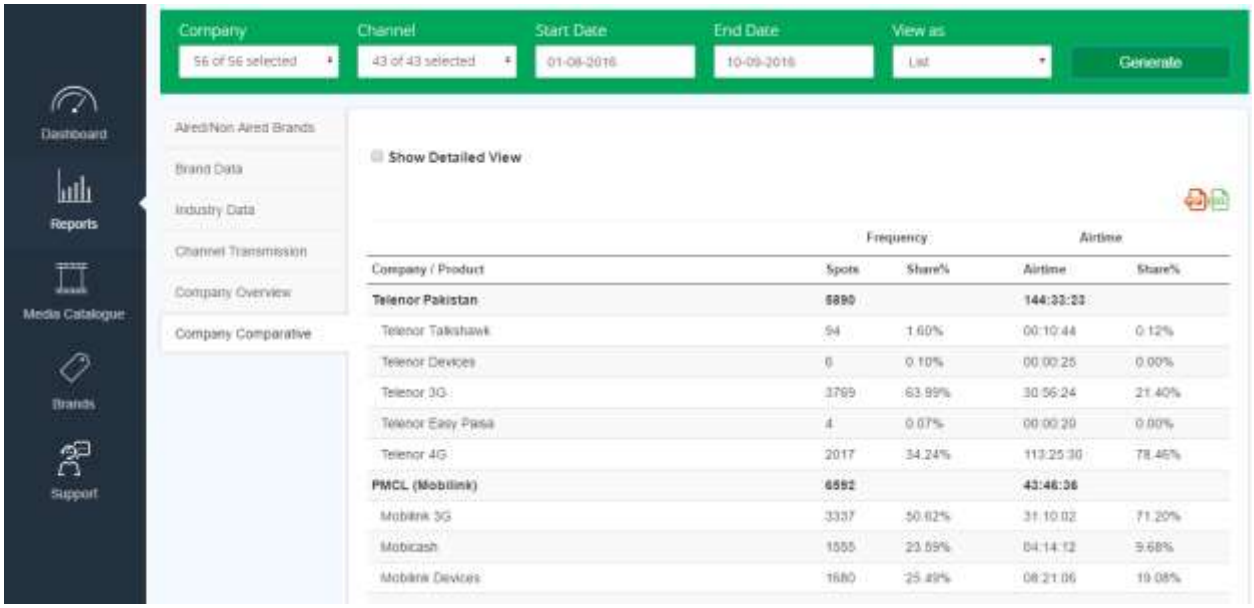

Figure 23: Company Comparative Report List View

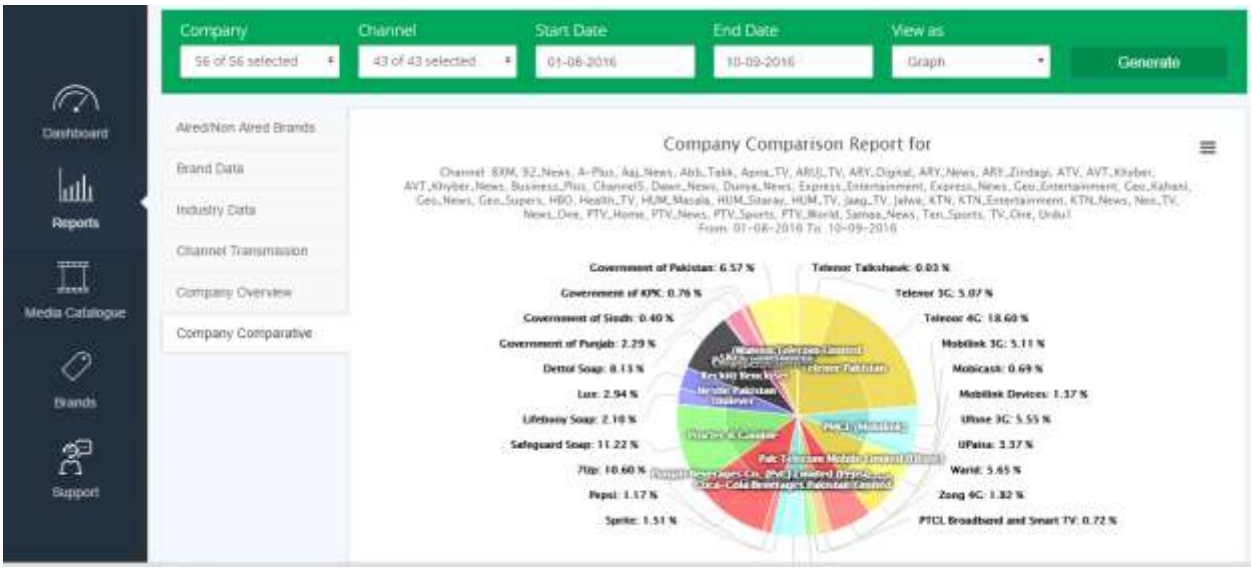

Figure 24: Company Comparative Graphical View

The figures 23 and figure 24 are about company comparative data, and these reports map out the competitors exhaustively and provide detailed competitive analysis, identify the competitive rank of each brand with their frequency and share of ads being played.

Conclusion

Ad Track provides an efficient and cost-effective solution for advertisement tracking. In a nutshell, it is concluded that advertisement through electronic media is a primary concern in these days. Promotion of the company products is much dependent on the electronic media and advertisements. Proposed strategy 3 in the market which facilitate the companies for the campaign of their products. But these organizations take extra hidden charges from the companies. The available advertisement tracking software's is not capable of tracking the videos played slots. But, the proposed system is capable enough to keep a proper record of played slots of the videos and provide hundred percent accuracy. VID Track provides an efficient and cost effective solution for the advertisement tracking.

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