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A Website for Your PC Benchmarks

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ABSTRACT:

Nowadays, everyone has/wants a computer system, but does not have sufficient knowledge to build one. And those who have some knowledge, face difficulties while selecting the hardware as the market for hardware is very huge. There are people who are looking to build or want to know more about computer hardware/ components. We provide users with detailed sections of various components like CPU, GPU, RAM and SSD. The user can see the specifications of the required component and learn more about that component. We compute and analyze the benchmarks of various components and systems such that the user can quickly size up their PCs and explore real world performance. Each and every component can be compared with one another individually as well as the whole computer system to have a better understanding of which one is better for someone.

Keywords – Computer System, Benchmarks, PC Building, PC Comparison, Hardware Comparison

1. INTRODUCTION:

Standardized benchmarks have become widely accepted tools for the comparison of software and hardware products. They are also regularly used for the evaluation of methodological approaches to problems in multiple fields of computer science and beyond.
To be acknowledged for normalization, benchmarks must meet a large group of value measures. Benchmark systems must go through a course of a few stages, including the proper software runs to determine the estimate performance of the system, using the correct test for the outcome of a specific component, and a number of thorough benchmark acknowledgment tests.

As part of this work, we give a definition of the term ***"benchmark"*** with regards to execution assessment. Note that we differentiate between benchmarks with the purpose of item correlation and rating instruments, which are intended for normalized estimations as a feature of an item development or assessment process. We likewise present the properties and criteria that any quality benchmark or rating apparatus must fulfill. For this, we centre around the properties that jobs of quality benchmarks should meet. We present numerous test piles of normalized benchmarks and show how these benchmarks guarantee the specific quality rules.

One of the challenges faced by IT managers and procurement specialists is how to specify computer performance in a practical and accessible way that generates competitive offers from suppliers. Tenders for desktop PCs and laptop computers often use a reference system to specify the minimum required performance. But even experts find it hard to compare the performance of different PC systems from their specifications alone. A better way to specify and compare the performance of computer systems is to use our application.

As we can see in today's world technology is growing exponentially but still there is a huge amount of population who face difficulty in understanding the hardware performance or even the basic functions. Our application will help the users in acquiring the knowledge about different hardware's and how to assemble their own computer without any hassle and saving a hefty amount of money.

2. LITERATURE REVIEW:

S.No	Title	Authors	Ref No.	Advantages	Disadvantages
1.	How to Build a Benchmark	Jóakim von Kistowski, Klaus-Dieter Lange	[1]	Explains what is benchmarks, how does it work and how to do it.	Does not provide any benchmarks or compare results.
2.	Computers in Context	Bo Dahlbom, Lars Mathiassen	[2]	Talks about the changes in computers through history.	Does not talk about the benchmarks of modern GPU, CPU.
3.	Evolution and trends in GPU computing	Marko Misic, Milo Tomasevic	[3]	Introduces to the general-purpose GPU computing and focuses on CUDA.	Performace of the GPU under different conditions is not discussed.
4.	Comparative Study on CPU, GPU and TPU	P Siva Raj, Ch Sekhar	[4]	The basic architecture views of CPU, GPU, TPU and their usage.	Speed of each and every component is not discussed.
5.	Comparison of Single-Core and Multi-Core Processor	Sukhdev Singh Ghuman	[5]	Deep understanding about Single-Core and Muilti-Core Processors.	Discusses about what is single and multi core processors but not about the performance.

3. METHODOLOGY:

This project includes many sections namely Build, Compare and a separate section for each hardware component with their purchase links and basic description of the hardware. The project has been implemented by using JavaScript, jQuery, Bootstrap in the front-end whereas NodeJS, ExpressJS were used in the back-end and MongoDB is the database used along with Mongoose.

3.1 Build

In the build section the user's selected components are sent to the backend via forms and are received via ExpressJS. Each and every component has its different **benchmark score** that has been collected over time for example – Intel i9-9900K has a score of '96.2', RTX 3080 has a score of '206' and similarly all the components have a different benchmark score. Now, all the score values are reduced to a scale of 0-100(PTS) (100 PTS being the maximum score) and based on a formula an average value is generated for a specific **computer build** and based on that average value the **performance** of that PC is generated. Based on their rankings the benchmark score is either multiplied or divided by specific values and is reduced to a factor less than 100 and their average is calculated.

FOR CPU,

```
cpuMark = productList['cpu'][cpuVal].Benchmark;
    if(cpuMark<=85) {
       cpuMark = cpuMark/1;
    } else {
       cpuMark = cpuMark*1.05;
    }
    cpuMark = cpuMark/100;
```

FOR GPU,

```
gpuMark = productList['gpu'][gpuVal].Benchmark;
    if(gpuMark<200 && gpuMark>101){
       gpuMark = gpuMark/1.05;
    }else if(gpuMark<=101 && gpuMark>80){
       gpuMark = gpuMark/1.32;
    }else if(gpuMark<=80){
       gpuMark = gpuMark/1.2;
    }else{
       gpuMark = gpuMark/1.1;
    }
    gpuMark = gpuMark/100;
```

FOR RAM,

```
ramMark = productList['ram'][ramVal].Benchmark;
if(ramMark < 110 && ramMark>100){
   ramMark = ramMark/1.05;
}else if(ramMark<=100 && ramMark>=20){
   ramMark = ramMark/1.1;
}else{
   ramMark = ramMark/1;
}
ramMark = ramMark/100;
```

FOR SSD,

```
ssdMark = productList['ssd'][ssdVal].Benchmark;
    if(ssdMark < 400 && ssdMark > 320){
       ssdMark = ssdMark/1.99;
    }else if(ssdMark<= 320 && ssdMark>250){
       ssdMark = ssdMark/2.1;
    }else if(ssdMark<=250 && ssdMark>170){
       ssdMark = ssdMark/2.25;
    }else if(ssdMark<=170 && ssdMark>120){
       ssdMark = ssdMark/2.3;
    }else if(ssdMark<=120 && ssdMark>100){
       ssdMark = ssdMark/2.35;
```

```
}else if(ssdMark<=100 && ssdMark>20){ssdMark =
   ssdMark/2;
}else{
   ssdMark = ssdMark/1;
}
ssdMark = ssdMark/100;
```

Final benchmark score is the sum of all the above-mentioned scores, i.e., gpuMark + cpuMark + ramMark + ssdMark.Here cpuMark,

gpuMark, ramMark, ssdMark are used to refer their benchmarks.

Similarly, all the links for purchasing and reading more about the components are generated along with the score generation.

In the Build section all these values are send via ExpressJS and here we have a subsection for Performance display which displays the average FPS (Frame Per Second) of various Games like GTA V, Shadow of The Tomb Raider, PUBG, etc. in different resolutions such as 4k, 2k(1440p), 1080p on ultra-settings. And these FPS are calculated by multiplying the benchmarks score generated above by the factor for that specific game like,

S.NO.	Game Title	1080p Factor	1440p (2k) Factor	2160p (4k) Factor
1.	GTA V	25.76	18.98	9.6
2.	Shadow of the Tomb Raider	23.3	16.11	8.9
3.	PUBG	23.2	17.49	10.2
4.	Forza Horizon	28.5	23.75	15.88
5.	Battlefield	28.9	22.16	12.69

Similarly, based on the benchmarks value, the prediction for Productivity software's such as Adobe Photoshop, Adobe Premier Pro, Adobe After Effects, etc. are displayed which gives a strong idea about the performance outcome of the PC.

3.2 Compare

In the compare section the user's selected components are sent to the backend via forms and are received via ExpressJS. Each and every component has its different **benchmark score** that has been collected over time, for example – Intel i9-9900K has a score of '96.2', RTX 3080 has a score of '206' and similarly all the components have a different benchmark score. Based on that benchmark score several properties are generated for each hardware component as follows,

I. **CPU**:

- **Effective Speed** - A measure of CPU speed geared towards typical users. Intel i9-10900K ≈ 100%. CPU Effective Speed (average bench) is calibrated to estimate differences in EFps between PCs.
  It is equivalent to the benchmark score of a specific CPU, like Intel Core i9-10900K has 100%, Intel Core i9-12900K has 114%, etc.
- **Average Score (Single-Core)** - It measures the ability of a processor to perform both integer and floating-point operations at the same time. This test only stresses one processing core at a time so it's a good measure of individual core performance rather than total calculation throughput.
  It is equivalent to 70-80% of the benchmarks score based on the rank of the CPU, the top 5 CPU shows around 70% and as the rank grows the value of percentage changes with it.

- **Overclocked Score (Single-Core) -** It is the peak value obtained when calculating the average score.
  It is usually observed that the overclock value is about 8-10% more of average score. Different CPU's have different overclocking score but they are usually not more than 10% of the average score.

II. GPU:

- **Effective 3D Speed - A** measure of 3D gaming performance. Effective Speed (average bench) is calibrated to estimate differences in EFps between PCs.
  It is equivalent to the benchmark score of a specific GPU, like Nvidia RTX 3090 has 233%, AMD RX 6900-XT has192%, etc.
- **Lightening Score -** This benchmark measures a GPUs ability to render complex lighting transport effects like soft self-shadowing, colored interreflections, and subsurface scattering (translucency).
- **Reflection Score -** This benchmark measures a GPUs ability to render two high dynamic range (HDR) techniques: tone mapping and blooming. HDR lighting effects require the ability to work with color values beyond the 0 to 255 range, usually by storing high range color data in textures. These methods produce bright reflective 3D surfaces.
- **MRender Score -** This benchmark tests a GPUs ability to use two features in Direct3D: render target array and geometry shader. A render target array allows multiple render target and depth stencil textures to be active simultaneously. By using an array of six render targets, one for each face of the cube texture, all six faces of the cube can be rendered together.
- **Gravity Score -** This benchmark tests a GPUs ability to calculate the interaction between multiple particles in a system. The interaction involves the influence of gravity between all possible particle pairs. Force splatting is used to calculate the N*N interactions.

All the above-mentioned scores are generated via a factor and that factor is some percentage of the effective speed and for different ranks of GPU this factor varies a lot, like for first 5 GPU's is quite similar but as the rank changes the factor changes with it and it is a very huge list, mentioned below is the factors for few GPUs with their ranks,

S.NO.	GPU Ranks	Average Score			
		Lightening	Reflection	MRender	Gravity
1.	1-5	130	126.5	148.5	109
2.	5-18	123	124	176.5	117
3.	18-22	135	133.5	136	105.5

Overclock Score factors for the above-mentioned properties,

S.NO.	GPU Ranks	Overclock Score			
		Lightening	Reflection	MRender	Gravity
1.	1-5	155	170	169	117.5
2.	5-18	136	156	186	122.5
3.	18-22	143	158.5	146	111.5

- **Overclocked Score -** It is the peak value obtained when calculating the Lightening Score, Reflection Score, MRender Score and Gravity Score.

III. RAM:

- **Effective Speed -** Real world performance scales reasonably well with memory frequency (data throughput). The more data transferred per second the better. If two sets of memory have the same bandwidth (GB/s) then the better performing kit will have lower latency.
  It is equivalent to the benchmark score of a specific RAM, like G. SKILL Ripjaws 4 DDR4 2400 C14 8x16GB has 121%, Crucial Ballistix Sport DDR4 2400 C16 4x4GB has 96.9%, etc.

- **Read Score –** A measure of how quickly the data can be read.
- **Write Score –** A measure of how quickly the data can be written.
- **Mixed Score –** A measure of how quickly the data can be written and read simultaneously.

All the above-mentioned scores are generated via a factor and that factor is some percentage of the effective speed and for different ranks of RAM this factor varies a lot, like for first 2-3 RAM's is quite similar but as the rank changes the factor changes with it and it is a very huge list, mentioned below is the factors for few RAMs with their ranks,

S.NO.	RAM Ranks	Average Score		
		Read	Write	Mixed
1.	1-2	40.16	41.4	37.5
2.	2-5	38.5	40.5	34
3.	5-18	37	40.5	33.8

Peak Score factors for the above-mentioned properties,

S.NO.	RAM Ranks	Average Score		
		Read	Write	Mixed
1.	1-2	49	48.4	45.5
2.	2-5	58	60	54
3.	5-18	65	68	58

- **Peak Score -** It is the peak value obtained when calculating the Read Score, Write Score and Mixed Score.

IV. SSD:

- **Effective Speed -** A measure of how well an SSD performs under typical consumer workloads.
  It is equivalent to the benchmark score of a specific RAM, like WD Black SN850 NVMe PCIe M.2 2TB has 475%, Intel 900P Optane NVMe PCIe 480GB has 420%, etc.

- **Read Score –** A measure of how quickly large files can be read from a device.
- **Write Score –** A measure of how quickly large files can be written to a device.
- **Mixed Score –** A measure of how quickly large files can be written to and read from a device simultaneously.

All the above-mentioned scores are generated via a factor and that factor is some percentage of the effective speed and for different ranks of SSD's this factor varies a lot, like for first 2-3 SSD's is quite similar but as the rank changes the factor changes with it and it is a very huge list, mentioned below is the factors for few SSDs with their ranks,

S.NO.	SSD Ranks	Average Score		
		Read	Write	Mixed
1.	1-2	716.3	762.5	567
2.	2-7	476	406	437.5
3.	7-15	557.5	888.5	577

Peak Score factors for the above-mentioned properties,

S.NO.	SSD Ranks	Overclock Score		
		Read	Write	Mixed
1.	1-2	867	959.5	646
2.	2-7	537	466	497.5
3.	7-15	647.5	1090	647.5

- **Peak Score -** It is the peak value obtained when calculating the Read Score, Write Score and Mixed Score.

In the Compare section all these values are send via ExpressJS and here we have a subsection for Performance display which displays the results of both the compared components/system along with a graph for a better understanding of whether it is good for Gaming, Workstation or Desktop. Some similar suggestions are also generated if the user is not satisfied with the performance.

The Graphs are generated via Google Charts, for specific component like CPU, it is usually responsible for handling the task management of the system, so it has a higher value in case of workstation computers and desktops whereas component like GPU is more responsible for generating graphics, rendering, etc. so it has a higher value in case of gaming computers, so based on these criteria the following factors are used to generate the graph,

Component / Usage	CPU	GPU	RAM	SSD
Gaming	1	1.1	1	1.1
Workstation	1.05	1.05	1.05	1.08
Desktop	1.02	1	1	1

4. RESULTS:

By building this project the users will benefit greatly as this will help them save large amounts of money and they will be able to gain tons of knowledge about the latest hardware available in the market all across the world. For the ones who are new to hardware will also be able to learn where each and every part is placed and what makes them compatible with one another. The user can compare their system/components with others and can understand the technical differences between the two and can make a choice accordingly keeping in mind the purpose and the budget.

5. CONCLUSION AND FUTURE SCOPE:

5.1 CONCLUSION:

In this paper, we have elaborated the various hardware components using benchmarks score which are important when a user wants to build his own computer system or compare its components with various others. This project covers the build feature which is building a computer on your screen, so the user does not waste his time any money by doing the same work offline. It also cover's the compare feature in which comparing different types of hardware components gives the user an idea on which type of GPU, CPU, RAM, SSD will be suitable for them depending on different factors such as speed, budget, etc. based on their needs.

5.2 FUTURE SCOPE:

This project can be used as a place where anyone can share his/her experience of different systems to help others across the globe. It could lead to a full-fledged information portal where people from different parts of the globe could come together and share their experience/views on different computer systems/components. People facing problems with their systems can help others to prevent the same mistakes that they've made or others can help them fix it.

The plan is to develop a Software that can compute your PC Benchmarks via running some specific tests on your computer, to get a better understanding of what your PC is actually capable of.

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