Project: Personal Health Monitoring System

CSE 5325 – Summer 2021

Project Management

Module: COCOMO

Deliverable: COCOMO Estimate Report

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TABLE OF CONTENTS

1. Introduction

The purpose of this document is to calculate the probable cost using COCOMO model and to compare it with the estimation we calculated before; our previous approach. The personal health monitoring system (PHMS) provides a very trustworthy system that the users can rely on for monitoring their health status. It also maintains and monitors all the vital signs of health such as blood pressure, cholesterol levels, glucose levels, and others so that the users can maintain a healthy lifestyle that is health-oriented. The system can be accessed through both Website and Android Apps. The system is to be accessible for use by 13 August,2021. The expected profit is 50% of the development cost.

To estimate both the cost and duration of the project,we have used COCOMO model tool by Softstar.Cost estimation with COCOMO model is different than the cost estimation without COCOMO model .It is due to the different salary rates from the previous estimation ,also we did not consider so miscellaneous cost in the previous cost estimation .And moreover ,the COCOMO model does not consider the working hours of the developers in order to finish the project .

The estimated duration of the project with COCOMO model is around 4.6 months (~138 days), it is greater than the project deadline we got from the stakeholders.This is because ,the COCOMO model only considers SLOC (Single Line of Code) as a factor,not the working hours of the human resources.The accurate cost estimation cannot be achieved at all ,since the size of this SLOC, in the early phase of system life cycle (Waterfall Model) is estimated with great uncertainty.
This report includes the brief description on the selection of both scale drivers and cost drivers for the COCOMO Model,and we also explained why choosing the value that would give an accurate estimation for cost, duration and effort for the project.

2. Estimating Factors

2.1 Source of Lines of Code

The following is the number of lines of code delivered as part of this project, a justification for the total amount of LOC is provided.

SLOC | Source Lines of Code	**Value Chosen: 4300**
We can follow the methods below to get the estimation of SLOC value. **Method 1**: To check the projects those are similar and we can compare the projects with the previous similar projects to examine the similarity and the differences and adapt the estimation . **Method 2**: We can ask for the estimation from the panel of experts for example, project managers and senior developer who have expertise on the projects. They estimate individually and ,do not interact directly and do influence each other ,and this is how the estimates are aggregated . The system can be accessed from both webpage and android application and keep tracks all the vital signs of health. Users should register at first and login before each use .Our system is very trustworthy to monitor health status. It also can update patients' data .We have followed the method 2 and got an aggregated estimation of 4300 SLOC.	

2.2 Scale Drivers

The following is the list of scale drivers, the values applicable to this project and a justification for each value chosen:

PREC | Precendentedness	**Value Chosen: High – Generally Familiar**
Justification:For this scale driver the value chosen is "High" since our team has developed similar projects in the past with a familiar application framework,and features.It could be further extended synchronously to fit for this project requirements.	

FLEX | Development Flexibility	**Value Chosen: Very Low - Rigorous**
Justification: The value chosen is “Very Low” for this scale driver because most of the requirements are fixed and very few requirements are expected to be changing. The mere success of this project depends on the whole implementation of the requirements, since there are already existing projects performing the same.So,we need to satisfy all the requirements strictly in order to have a popular usage and stand out from its predators.If any of the requirements are not met stakeholders will not accept it and it will cause a loss .So ,we need to meet all the requirements.	

RESL | Architecture / Risk Resolution	**Value Chosen: Very High – Mostly (90%)**
Justification: The value chosen is “Very High – Mostly (90%) for this scale driver because there may be an uncertainty with respect to risks that do not have sudden counter action. Although the architecture is established well prior to the initialization of the project and the project is equipped with skilled software architects.	

TEAM | Team Cohesion	**Value Chosen: Very High – Highly Cooperative**
Justification: Team members have a good interaction for working with the requirements, objectives and specifications. With the previous projects ,the team did great and they maintain a high professional atmosphere So ,the value chosen is “Very High – Highly Cooperative” for this scale driver.	

PMAT | Process Maturity	**Value Chosen: High – SEI CMM Level 3 – “Defined” – SW process is standardized.**
Justification: The value chosen is “High” for this scale driver because there’s a set of defined and documented standard processes which are established specific for this project and these are improved as the time progresses ,so each of our organization development process and its tools are standardized .In our case,we have specified that we will apply towards 2 different modules such as web application and android application.	

2.3 COST DRIVERS

The following is the list of cost drivers, the values applicable to this project and a justification for each value chosen:

ACAP | Analyst Capability	**Value Chosen: Very High**
Justification: Analysts selected in our team to do the project are exceptionally good in the business. They have prior knowledge in developing similar projects, they are well acquainted with each other ,good in communication and cooperation within the team and with stakeholders as well.	

APEX | Applications Experience	**Value Chosen: High**
Justification: My team members have 3-5 years of domain experience,they are very well experienced wit actively being involved in several other tasks along the line ,so we have kept the value high.	

PCAP | Programmer Capability	**Value Chosen: Very High-90th percentile**
Justification: The team members assigned to this project are experienced ,capable and competent .They have been gone through rigorous and process multiple steps of hiring,in order to make sure that they are the most suitable for the position they are given in the project.	

PLEX | Platform Experience	**Value Chosen: Very High-6 years**
Justification: My team members has a lot of prior experience in these platforms because we have developed various web applications that uses HTML5, MYSQL,php, JavaScript, CSS3 successfully and Android studios for Android.So,the team members are quite familiar to the platforms those are currently being used in this project ,too.	

LTEX | Language and Tool Experience	**Value Chosen: Very High-6years**
Justification: The team has an experience of 7.5 years working with android studio, using java,sql ,database to develop android apps .Also we have 6 years' experience in the development of websites using Adobe Dreamweaver.	

PCON | Personnel Continuity	Value Chosen: Nominal – 12% turnover per year
Justification:In our team,anyone is barely completely new,most of them are turned out to be associated from previous projects.So ,the turnover projected is nominal.With the success of this project , we will able to choose 6% turnover per year as the annual turnover will increase.	

TOOL | Use of Software Tools	Value Chosen: Very High
Justification: Multiple Tools utilized are integrable and automated into our workflow to get the efficiency and accuracy in this project. Most of the tools are compatible and mature with the platforms that available in the market.	

SITE | Multisite Development	Value Chosen: Extra High
Justification: It becomes easy for us to stay in persistent communication and interact as we needed, as we have rented an office space which we will be using for this project. This solves the communication issues and keep the team motivated,active.	

SCED | Development Schedule	Value Chosen: Very Low
Justification: The deadline given by the stakeholders is 2 months which is pretty tight development schedule. With proper plan and execution, we can finish the project successfully within 2 months. As we have taken waterfall model which is a liner sequential life cycle model, and each stage is well defined. In this implementation stage, we had the developers be divided into 2 group consisting of 3 people each. Those 2 groups are simultaneously working to implement webpage, android app at the same time. Currently the team is focusing on developing the project which has not much complexity and has nominal documentation. Thus ,we have chosen 75% of nominal schedule.	

TIME | Execution Time Constraint	Value Chosen: Nominal
Justification: This project Personal Health Monitoring System is highly dependent on the users ,on interaction. The system is never scheduled to be shut down that is, it will be running at all times but with some exceptions, it can periodically be idle sometimes.	

STOR | Main Storage Constraint	Value Chosen: Nominal (50%)
Justification: We will be using cloud hosting where if 50% of available storage is used, we can easily scale up and maintain our performance. So, the data storage constraints are not a major concern for this project .Thus, the value we have chosen for this cost driver is “Nominal” .	

PVOL | Platform Volatility	Value Chosen: Low
Justification: The platforms that we are using are already well established so there won't be major changes other than small bug fixes and minor updates.That's why we have chosen the value to be Low.	

RELY | Required Reliability	Value Chosen: High
Justification: Value is chosen "High" as this is a sensitive project which involves transaction being processed every time by the services provided by the user and services consumed by customer, if software failure takes place it affects these transactions causing them to abort which may lead to financial loss to both users using the application and clients.	

DATA | Database Size	Value Chosen: Nominal
Justification: The amount of data required to be tested is chosen to be nominal because,only certain parts are to be strictly tested such as payment section where transactions are involved.	

CPLX | Product Complexity	Value Chosen: Nominal
Justification: For this cost driver we have chosen the value nominal as the project involves monitoring the vital signs of health, and login service which are pretty straight forward implementation. The little bit of difficult part of the project is implementing the demand which involves nested code. Other than that, most of the project is not that complex.	

RUSE | Required Reusability	Value Chosen: Low
Justification: Developing software components to be reused is much more expensive, for this reason cost driver we have chosen the value "low" because.So to reduce the cost as much as possible we decided to not include reusability in our components.	

DOCU | Documentation match to life-cycle needs	Value Chosen: Very High
Justification: There is no scope of changing the requirements once the project the development starts in this model. Because we are using waterfall model more emphasis is given to the documentation.	

3 Project Final Timeline and Cost Structure

Earlier Estimation – Assignment 2

Stages	**Duration**	**Start**	**Finish**	**Cost**	**Work**
Requirements	6 days	06-15-2021	06-22-2021	$9,600	160 hrs
Design	10 days	06-23-2021	07-06-2021	$14,400	256 hrs
Implementation	17 days	07-07-2021	07-29-2021	$32,000	560 hrs
Testing	8 days	07-30-2021	08-10-2021	$12,800	192 hrs
Deployment	3 days	08-11-2021	08-13-2021	$4,000	72 hrs
Miscellaneous Cost				$9,650	
Total Cost				**$82,450**	**1240 hrs**

Selling price to client = $82,450+ ($82,450* 0.5) = $123,675

Profit = $41,225.

COCOMO ESTIMATION

Totals for entire Project		Effort (PM)	Duration (Mo)	Cost (K$)	Productivity	Equivalent Size
Requirements	RQ:	0.3	0.7	3.1		Total Size: 4,300
Development	PD+DD+CT+IT:	4.5	3.9	79.9	945.9	
Total	RQ+PD+DD+CT+IT:	4.9	4.6	83.0	884.0	

Stage	COCOMO ESTIMATED VALUES	Duration
Requirements - RQ	3.1k = $3100	0.7 Months (~21 days)
Development – PD+DD+CT+IT	$79.9k = $79,900	3.9 Months (~117 days)
Hardware Cost	$5000	
Software cost(Including Security software package)	$8000	
Paid vacation for each team member for 1 week	$5000	
Health insurance	$5000	
25% overhead cost of total	$26,500	
Total Cost	**$1,32,500**	**4.6 Months (~138 days)**

Selling price to client = $132,500 + ($132,500*0.5) = $198,750

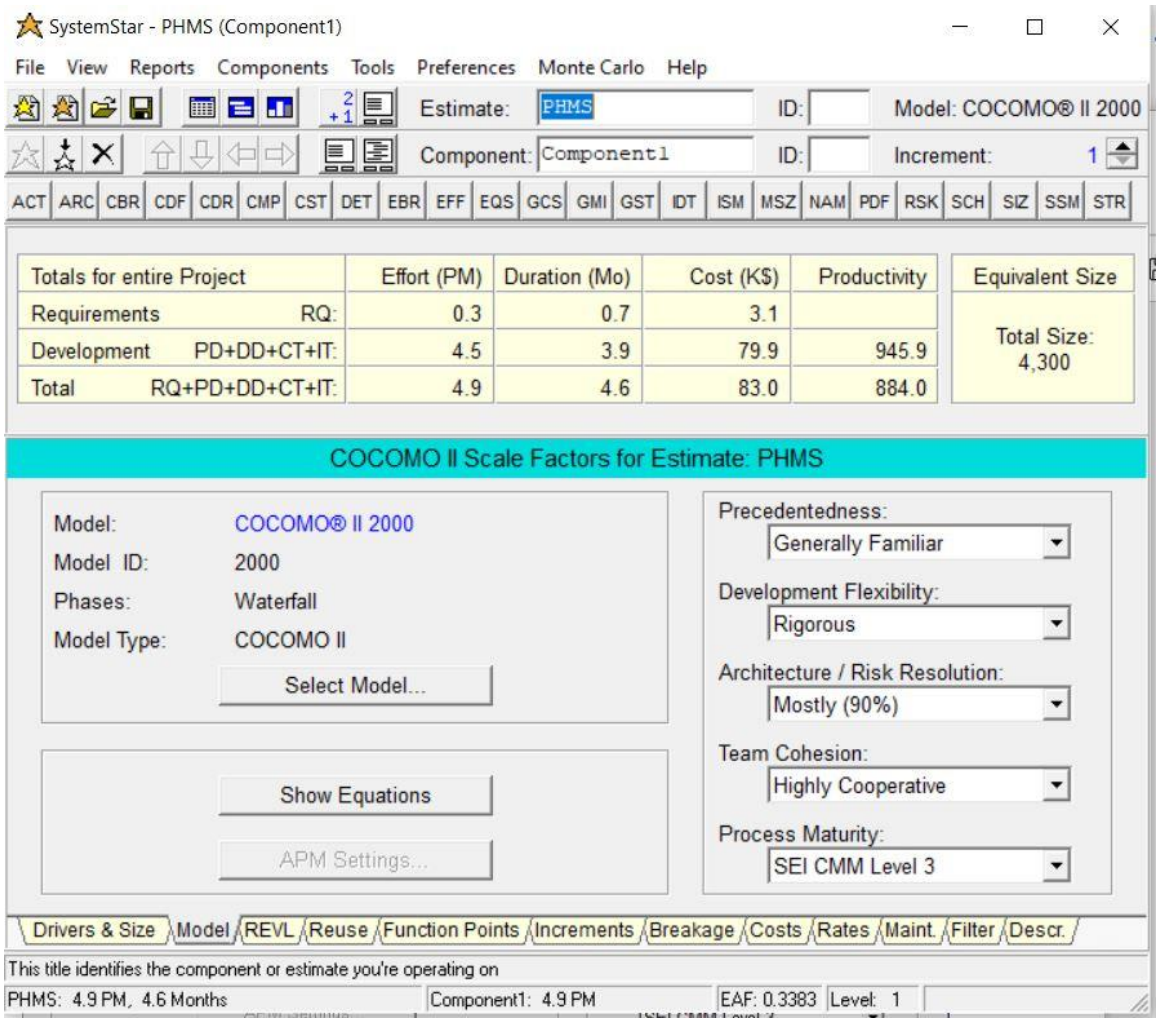
Profit = $66,250

4. Conclusion and Recommendations

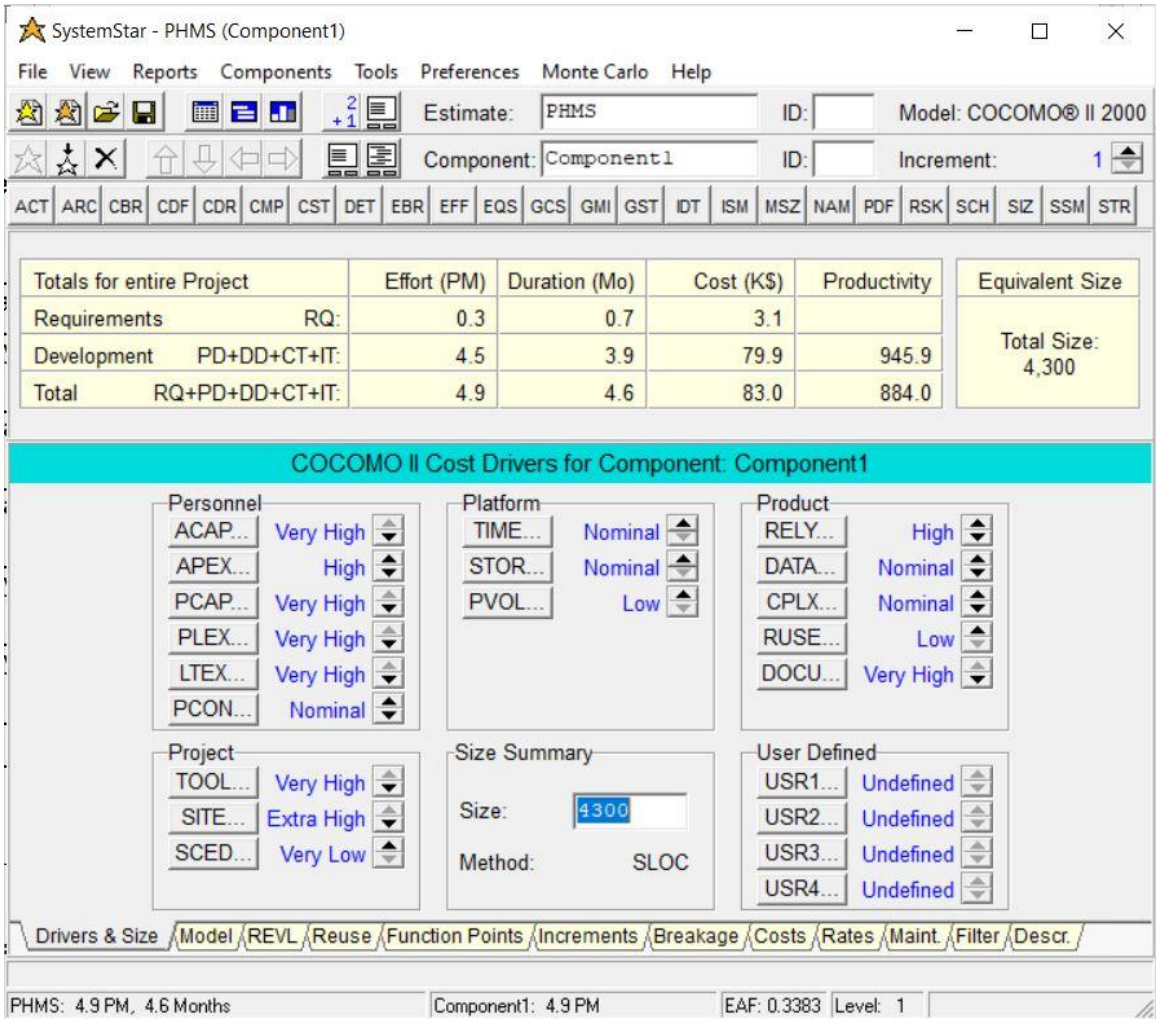
The total cost estimation that was done without COCOMO model is less than the cost estimation done with COCOMO model .That is because in the previous cost estimation, someof the miscellaneous costs were ignored.Also the duration estimated by COCOMO model is 4.6 months ,which is not feasible to finish the project in accordance to the 2 months of given time period by the stakeholders ,due to functionalities and expected size of the project.The estimates are different since the COCOMO model doesn't consider the number of human resources working on the project as a factor and consider SLOC(Single Line of Code) strongly which is used in the estimations of the Effort, Duration, Cost and Productivity.We need to know the size of the project in order to work out the required effort for the project.It would be easier if we knew the amount of the code required by an implementation ,then we could provide an approximate time estimation for how long the implementation would take.As our selected members in the team are quite experienced with similar projects doing in the past ,I believe we can keep the project on and complete it on time fixed by the stakeholders.We will be profited 50% by selling the project over the total cost to the client.In my view ,due to time constraint we should change the model from waterfall to increamental development model and deliver some of the initial versions with major functionalities of the application ,so that it will be adequate for the majority of the users and can add more functionalites later by providing updates in the application.

Appendices

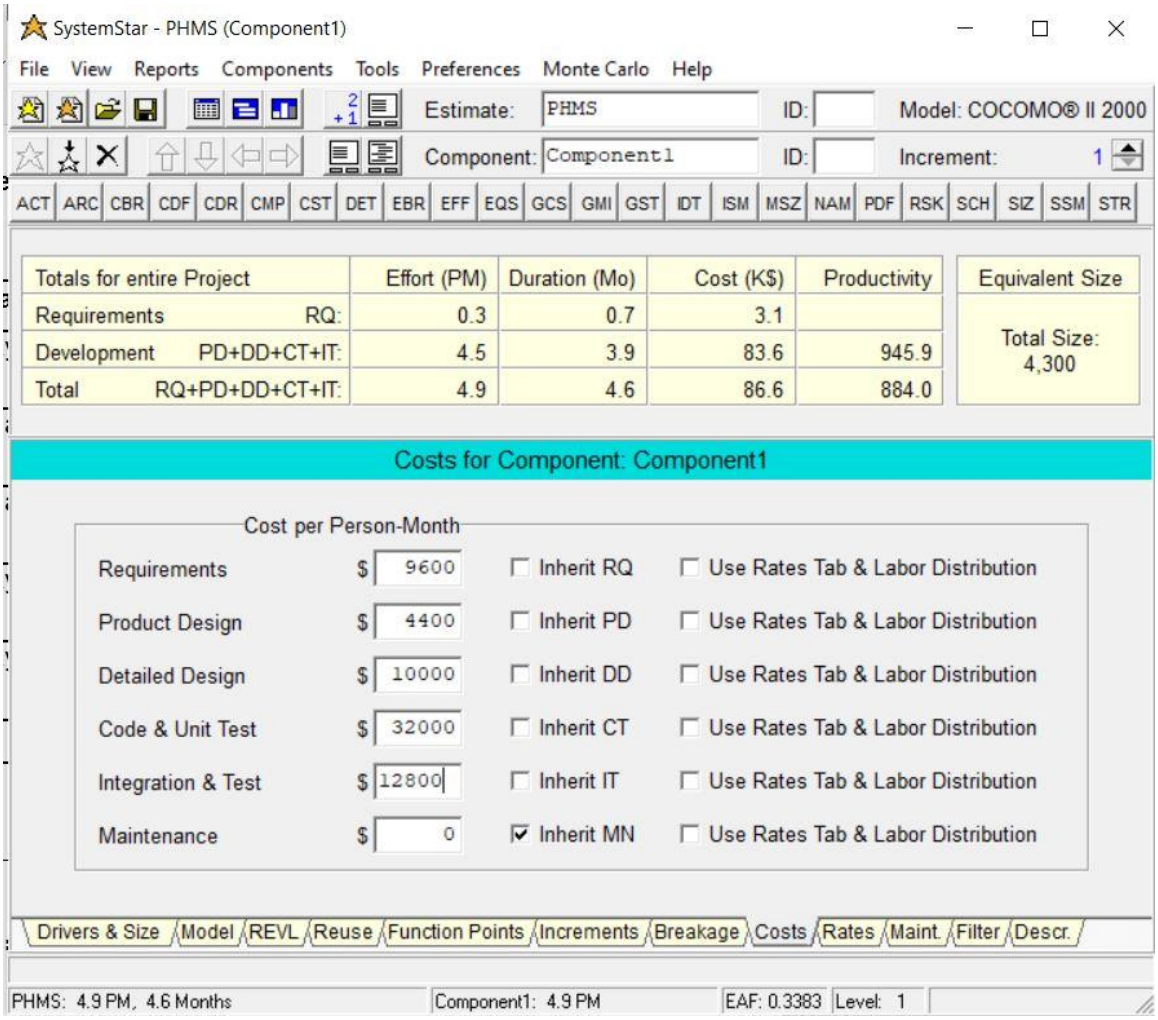
1. COCOMO – Scale Drivers



2. COCOMO – Cost Drivers



3. COCOMO – Costs for Component



4. Dr Bahram Khalili Lecture Videos.

5. [Overview of COCOMO (softstarsystems.com)]

6.https://www.lenovo.com/us/en/laptops/thinkpad/thinkpad-x/ThinkPad-X1-Carbon-6thGen/p/22TP2TXX16G?gclid=CjwKCAjw4LfkBRBDEiwAc2DSlKnMiBC9pgva0qUHhUaG317zKAVHb3NEoCjpjfzeN46RdUYQGGvIBoCkCYQAvD_BwE&cid=us:sem|se|google|304162709701|Lenovo_ThinkPad+X1+carbon|IIP_NX_Lenovo+Thinkpad+X1+Carbon_Similar+Audience|951617945&s_kwcid=AL!4030!3!285420156141!e!!g!!lenovo%20thinkpad%20x1%20carbon%20price&kw=lenovo%20thinkpad%20x1%20carbon%20price&adid=285420156141&addisttype=g&ef_id=CjwKCAjw4LfkBRBDEiwAc2DSlKnMiBC9pgva0qUHhUaG317zKAVHb3NEoCjpjfzeN46RdUYQGGvIBoCkCYQAvD_BwE:G:s&s_kwcid=AL!4030!3!285420156141!e!!g!!lenovo%20thinkpad%20x1%20carbon%20price&kw=lenovo%20thinkpad%20x1%20carbon%20price&adid=28542 0156141&addisttype=g - lenevo laptop price reference 17

7. https://store.google.com/config/pixel_3 - pixel price review

8. https://www.amazon.com/Multi-Touch-Point-Infrared-ScreenOverlay/dp/B07D1ZFRYQ/ref=asc_df_B07D1ZFRYQ/?tag=hyprod20&linkCode=df0&hvadid=312727440900&hvpos=1o3&hvnetw=g&hvrand=18351095566215441057&h

vpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9027194&hvtargid=pla615578619827&psc=1 - touch screen board

9.https://www.dell.com/enus/work/shop/accessories/apd/a9829793?mkwid=ss1J6CoXn&pcrid=177747642662&pkw=&pmt=&pdv=c&slid=&product=A9829793&pgrid=40609578198&pgrid=40609578198&ptaid=pla312493201084&ptaid=pla312493201084&VEN1=ss1J6CoXn,177747642662,901q5c14135,c,,A9829793,40609578198,pla312493201084&VEN1=ss1J6CoXn,177747642662,901q5c14135,c,,A9829793,40609578198,pla312493201084&VEN2=,&VEN2=,&dgc=st&dgc=st&dgseg=bsd&dgseg=so&acd=12309152537501410&acd=12309152537501410&cid=309068&st=&gclid=CjwKCAjw4LfkBRBDEiwAc2DSlH8cV6hYjxeoV6rWRG3WcpdGora4lhv7Bo8W718BIO2klGrXa8ExoC6z8QAvD_BwE&lid=5842977&VEN3=112904605687806794 - printer price reference 7. http://buystatic.norton.com/norton/ps/ad/pages/us/1up_nsbu_us_en_fluid_notw_brnf.html?om_sem_cid=hho_sem_sy:us:pla:en:l%7ckw0000492973%7c48028927396%7cc%7cgoogle%7c318255916%7c15425864236 %7caud-452923453197:pla-437695511405&nortoncountry=US&pgrid=15425864236&ptaid=aud452923453197:pla-437695511405&gclid=CjwKCAjw4LfkBRBDEiwAc2DSlGHKoigWOhtFUHoXq_ZKL0tpdMnC6a_YpbwNRT5s bzGFL8nORtMb6hoCKJEQAvD_BwE&gclsrc=aw.ds - security software reference