

Project Report

Group 2

Total Words: 1100, excluding tables and references.

Design Methodology

The Agile scrum methodology is an effective approach to project management. It involves breaking tasks into incremental deliverables and prioritising them in a “Backlog” (Wrike, N.D). Continuous iterations and testing gather user feedback for product improvement (Ilieva, Ivanov and Stafanova, 2004). Scrum is adaptable to changing requirements. It fosters constant communication, making it essential for managing complex product requirements.

According to Burn, “technology changes so quickly nowadays and you don’t want to lock users into an obsolete system.” Taking this into account, an Agile approach aids this process and encourages continuous improvement, whilst keeping up with industry standards (Srivastava, Bhardwaj and SaraSEat, 2017).

Requirements

Table 1 and 2 displays all requirements (Stellman & Greene, 2006). Additionally, Appendix A presents the table’s information in the form of Gherkin statements (Cucumber, N.D).

Table 1: Hardware Requirements

REQUIREMENT	Specified (S)/ Assumed (A)	Achievable Yes (Y)/ No (N)
Motorola 68k series CPU	S	Y
Minimum of 512Kb of RAM	S	Y
Portable/luggable form factor	S	Y
Built-in screen	S	Y
Storage devices: <ul style="list-style-type: none"> ○ Solid-state ○ High capacity ○ Fast ○ Low power ○ Standard drive or as expansion 	S S S S S	N N N N Y
Industry standard compatibility	S	Y
Expansion slots for native and third-party expansion packs	S	N
Serial ports for networking and communications	S	Y
Centronics printer access	S	N
SCSI	S	N
Keyboard connector and joystick port	S	Y
Multiple serial RS485/422 ports	S	Y

Mouse	A	Y
External display connection	S	N
Maximum weight of 2 kgs, including computer, batteries, screen, and peripherals	S	To Confirm
Battery life of at least 2 hours	S	N

Table 2: Software Requirements

REQUIREMENT	Specified (S)/ Assumed (A)	Achievable Yes (Y)/ No (N)
Pre-bundled business suite: <ul style="list-style-type: none"> • Word processor • Spreadsheet • Database • Graphics applications 	S S S S	Y Y Y Y
Operating system: <ul style="list-style-type: none"> • Multi-tasking • GUI • Unix-like • Support high resolution graphics (512 colours, 1024 x 768 resolution) 	S S S S	Y Y Y Y
HBConversion application to convert existing TB programs	S	N
Game Emulator for old games	S	N

Scope of Work (SoW)

Table 3: Project Deliverables (Stellman & Greene, 2006)

Deliverable	Category	Assignee
Preliminary Hardware Production Design	Design	Hardware Architect (HA) / Hardware Engineer (HE)
Hardware Production Cost Estimate	Design	HE
Hardware Schematic Design	Design	HA/HE
Printed Circuit Board (PCB) Design	Design	HA/HE
HB/OS Operating System (OS)	Design & Implementation	Software Architect (SA)/ Software Engineer (SE)

EZ-Suit	Design & Implementation & Accept Testing	EZ-SYS to deliver software and internal Software Engineers to perform acceptance testing.
Hardware Prototype Testing with Three Units	Testing	HE
System Testing	Testing	SE/HE
Enclosure and Screen Design	Design	HA/HE
Final Design	Design	HE
Establish Manufacturing Contracts	Manufacturing	Project Manager (PM)
Establish Sales Contracts	Sales	PM
Project Reports	Project Management	PM

Work Breakdown Structure (WBS)

Please note that all design and manufacturing costs in terms of person.weeks were taken from the supplied design times in the provided hardware and software Bill Of Materials (BOMs). Furthermore, the person.weeks were shared between the planned activities.

Assumptions and points of note:

- The Planning Poker estimation method was used to achieve the task timeframes (University of Essex, 2023a; Raeburn, 2022).
- There will be no delay in parts orders.
- Established contracts already exist with relevant parts suppliers and manufacturers.
- All required resources are available, and a resource list is not required (Stellman & Greene, 2006).
- Resource assumptions include:
 - No testing equipment like oscilloscopes or multimeters need to be purchased.
 - No design or testing software needs to be purchased.
 - No safety equipment or Personal Protective Equipment (PPE) is required.
- The hardware engineer can do isolated unit-level designs.
- A sales contract needs to be established.
- A fair bit of the administrative tasks are not accommodated in the SoW or WBS.
- The risk management strategy for the project will be provided in a separate document (University of Essex Online, 2023a).
- The PM will also perform the duties of a Project Analyst (monday, 2021).
- Prototype testing would require three physical units in case hardware changes need to be compared between iterations (Quinn, N.D).
- During the prototype testing there will be iterations consisting of testing and making changes (Quinn, N.D; Teel, 2022).
- The software team is familiar with the scrum development style.

- The free components required for OS development have been licensed.

Table 4: Project Tasks Breakdown (Stellman & Greene, 2006)

Tasks	Effort Estimate (person.weeks)	Assignee
Preliminary Production Design:	3	HA/HE
Assess requirements in terms of features and budget	1	HA
Create functional system block diagram	1	HA
Select suitable components	1	HE
Production Cost Estimate:	3	HE
Estimate hardware costs	1	HE
Estimate labour costs	1	HE
Estimate manufacturing costs	1	HE
Schematic Design:	11	HA/HE
CPU, RAM, ROM	3	HA
Peripherals	4	HA

Circuit integration	4	HE
PCB Design:	8	
Design component layout	4	HA
Design component interconnections	4	HE
HB/OS Operating System with CLI:	110	SA/SE
Komai and others provide a method that allows us to understand how to transition from traditional estimation to an agile approach in terms of effort (Komai et al., 2016). By employing the Scrum methodology for software development, design, coding, and testing can be conducted concurrently.		
Booter and hardware configuration design	1	SA
Booter and hardware configuration coding	4	SA/SE
Booter and hardware configuration testing	4	SE

Booter and hardware configuration potential reworking	2	SA/SE
OS kernel design	4	SA
OS kernel coding	12	SA/SE
OS kernel testing	12	SE
OS kernel reworking	6	SA/SE
OS libraries potential reworking	4	SA/SE
OS drivers potential reworking	2	SA/SE
OS kernel extension potential reworking	3	SA/SE
OS graphics driver design	2	SA
OS graphics driver coding	8	SA/SE
OS graphics driver testing	8	SE
OS graphics driver potential reworking	2	SA/SE
BAS kernel design	4	SA

BAS kernel coding	12	SA/SE
BAS kernel testing	12	SE
BAS kernel potential reworking	4	SA/SE
BAS core libraries and I/O potential reworking	4	SA/SE
HB/OS Operating System GUI:	40	SA/SE
GUI design	4	SA
GUI coding	16	SA/SE
GUI testing	16	SE
GUI potential reworking	4	SA/SE
HB/OS Operating Enhancement:	20	SA/SE
BAS wrappers design	1	SA
BAS wrappers coding	4	SA/SE
BAS wrappers testing	4	SE

BAS potential reworking	1	SA/SE
BAS extensions design	2	SA
BAS extensions coding	4	SA/SE
BAS extensions testing	4	SE
EZ-SUITE Accept Testing:	8	SE
Testing	8	SE
Prototype Testing with Three Units:	7	HE
Order and attain parts	1	HE
Print circuit boards	1	HE
Solder components to boards	1	HE
Individual hardware circuit tests	2	HE
Integrated hardware tests	2	HE
System Testing:	8	SE/HE
Application testing on PC	4	SE

Peripheral and driver testing PC	4	HE/SE
Enclosure and Screen Design:	12	HA/HE
Outside panels	5	HA
Mountings	5	HE
Screen design	2	HA
Finalise Design:	3	HE
Update schematic design	1	HE
Update PCB design	1	HE
Update BOM	1	HE
Establish Manufacturing Contracts and Product Tracking:	3	PM
Liaise with manufacturers around requirements and order units	1	PM
Track orders	2	PM
Establish Sales Contracts:	4	PM
Liaise with sellers	2	PM

Establish Contracts	2	PM
Project Reports:	6	PM
Liaise with all parties including senior management, technical staff, and customers	3	PM
Analyse projections and create reports for management	3	PM

Please see attached Gantt chart related files in the GanttChart.zip.

Component Selection and Design Strategy

After analysing the initial customer requirements the following was performed to minimise costs:

- A separate chip enabling a joystick to be plugged in whilst simultaneously having the keyboard and mouse connected was not selected. It is assumed that a person using a computer for business tasks would use the mouse and keyboard, and then remove the mouse and insert a joystick for gaming.
- The board will be designed with four RAM slots providing a maximum of one Megabyte, however only two slots will be populated allowing another 500KB to be soldered in at a later stage.
- Fixing chips rather than using sockets was chosen, as changing some components would require a PCB redesign anyway, and it is assumed that most people would not want to be upgrading a computer which is targeted as 'entry-level' and business oriented.

- A single storage drive was used that can fit one of two disk form factors to minimise system size in addition to cost.
- The OS will not support old games requiring emulation, however, newer games built for the platform will still work.

Costs

Table 5: Component, Software, and Manufacturing Costs

Item	Model	Quantity	Unit Price £ (qty thousand)	Total Cost per PC
EZ-SUIT	-	1	25	25
CPU2	68k8	1	5.5	5.5
ULA	G1	1	5	5
ULA	G2	1	5	5
ULA	G3	1	5	5
ULA	G4	1	5	5

Misc	resistors, caps, etc	100	0.05	5
INTSND	i8042	1	1.5	1.5
ROM	16K	1	2	2
RAM	256Kb	2	5	10
BOARD-SLDR	A83	1	15	15
IOP-J	SC100	1	12	12
IOP-J	SC150	1	15	15
STORAGE	mixed	1	12.5	12.5
CASE	LUGGABLE	1	35	35
KEYB	ext	1	7.5	7.5
SCREEN	4"flat	1	20	20
Battery	Package	1	2.5	2.5
BOARD-SLDR Manufacture	A83	1	10	10
CASE Manufacture	LUGGABLE	1	20	20
Battery Manufacture	Package	1	6	6
SUBTOTAL				224.5
TOTAL (2000 UNITS)				449000

Table 6: Internal Labour Costs

Professional	Cost Person.days	Professional Rate (£/day)	Amount (£)
HA	100	250	25000
HE	135	175	23625
PM	65	275	17875
SA	234	300	70200
SE	548	195	106860
TOTAL			243560

Table 7: Outsourced Labour Costs

Professional	Cost Person.days	Professional Rate (£/day)	Amount (£)
SA	35	450	15750
SE	120	295	35400
TOTAL			51150

Due to the costs exceeding the assigned budget of £500000, the company will absorb in-house labour costs until such time that sales can recuperate the losses (University of Essex Online, 2023b). The sale price will allow for sufficient profit margin to enable overhead coverage.

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Appendix A

feature: CPU Requirements

scenario: OS Executing Process

Given The computer is SEitched on and the OS

when choosing a CPU

then I will use a motorola 68k series CPU

and with a minimum of 512Kb of RAM

then the computer will be compatible with subsequent chips

Feature: Expansion option

Rule: Forward compatibility

Given the user buys an expansion pack

Given the user possesses a third party expansion pack

Then the user is able to upgrade his machine

Feature: Emulator

Rule: Backward compatibility

Given the old game is installed

When the user starts the game

Then the emulator should run all old games at same speed as existing machines

And run a business application at the same time

Feature: EZ business suite

Given the PC runs on HB/OS

Then the user should be able to use the word processor

And EZ-Sheet

And EZ-DB

And EZ-Graph

Feature: Error logs

Scenario: the PC boots into HB/OS

Given that there is media space in cartridge B

Then the OS will log warning messages

And error messages

When the media is full

Then the OS will crash

Feature: Ports

Scenario: fitting of ports

Given the gamer needs a controller

and the user should be able to use a keyboard connector and joystick port

When the port is fitted

Then the connection is established with the PC

Feature: Memory

Scenario: ROM configuration

Given a minimum requirement is a single 8KB ROM containing the boot loader and hardware configuration app

When ROM chips are installed

Then the PC can store data on the chip

Feature: Portable PC

Rule: portability

Given the PC has portable power source

And portable dimensions

Then the user can use it anywhere

Feature: Battery life and portability

Rule: portability

Given personal computer

When finalizing the design

Then should aim for a lightweight and portable form factor, weighing a maximum of 2 kilograms

And It should have a minimum 2-hour battery life to ensure portability and usability on-the-go

Feature: RAM

Scenario: PC multitasking

Given PC is on and working

When choosing RAM size

Then select enough RAM for emulator to launch

And business application to run simultaneously

Feature: Keyboard interchangeability

Given: Keyboard port

When the user utilizes another keyboard layout

Then the user should be able to easily SEitch keyboard via port connection

Feature: Network Connectivity

Scenario: Using Network Connections

Given the Synputer is powered on and connected to a network

When the user selects the "Connect to Network" option

Then the Synputer scans for available networks and displays a list of network options to the user

And the user can select and connect to a desired network by providing the necessary credentials