**COP Dismounted**

**System Design Description**

Date: **05/10-10**

Company: **Company F**

Authors: **Kaj N. Nielsen, Kenneth Pihl, Anders H. Poder, Lars Munch**

Revision: **A**

Document ID: **COPDvA**

**Index**

[1. 1. Scope. 2](#_Toc273452989)

[1.1 1.1 Identification. 2](#_Toc273452990)

[1.2 1.2 System overview. 3](#_Toc273452991)

[1.3 1.3 Document overview. 3](#_Toc273452992)

[2. 2. Referenced documents. 4](#_Toc273452993)

[3. 3. System-wide design decisions. 4](#_Toc273452994)

[4. 4. System architectural design. 6](#_Toc273452995)

[4.1 4.1 System components. 6](#_Toc273452996)

[4.2 4.2 Concept of execution. 12](#_Toc273452997)

[4.3 4.3 Interface design. 12](#_Toc273452998)

[5. 5. Requirements traceability. 14](#_Toc273452999)

[6. 6. Notes. 14](#_Toc273453000)

[7. A. Appendixes. 14](#_Toc273453001)

[8. Niv 1 14](#_Toc273453002)

[8.1 Niv 2 14](#_Toc273453003)

**History**

|  |  |  |  |
| --- | --- | --- | --- |
| **Date** | **Description** | **Name** | **Version** |
| 05/10 2010 | Document created | AHP | 1 |
| 06/10 2010 | Adding drawings and section 1 - 4 | AHP | 2 |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

# Scope

## Identification

This document describes the system design of the dismounted version of the Common Operations Picture (COP) situational awareness platform. The a Dismounted COP is achieved by scaling the full COP, as defined by the SiteWare Tracking Server system (ref. main project) to fit a portable device and adding required security, communication and location measures.

## System overview

The system is a Dismounted COP, enabling military, disaster and other required personal to gain an overview of the battlefield, crises or other situation.

The system allows for integration with other military and disaster systems as defined by the Systematic SiteWare Track Server system (ref. main project).

The Dismounted COP must be able to transmit its current location to the tracking server, as well as receive tracking and other information from the server about units and activities in the area.

The system must be battery powered, mobile and operational under extreme conditions and while wearing gloves.

An overall system drawing may be seen in Figure 1.



Figure 1: System drawing of the Dismounted COP.

## Document overview

This document details the overall system design and its purpose is to guide the detailed design of the dismounted COP to achieve the optimal solution while keeping the overall goal abreast as well as document any rationales of rejected technologies or designs and pinpoint risks and areas with tight requirement traceability (areas where extra care must be taken to meet requirements).

# Referenced documents

|  |  |  |
| --- | --- | --- |
| **Doc. ID** | **Name** | **Description** |
| STSSvA4 | SiteWare Tracking server system | The complete documentation of the SiteWare Tracking server system which this Dismounted COP is a portable version of. |
| SOW |  | Statement of work from main contractor. |
|  |  | Q&A regarding SOW from main contractor. |
| CLi-ionvB | Cobolt Li-ion specification | Details about the performance, weight and handling of the Cobolt Li-ion power cell. |
| GSMv5 |  |  |
| SATv6 |  |  |
| WLANv7 |  |  |
| RFv8 |  |  |
|  |  |  |

# System-wide design decisions

In order to best understand the design decisions, risks and challenges it is beneficial to have a comparable device to measure against. For that purpose the Apple iPad is well suited, as it is similar in physical dimensions and capabilities. In the table below may be seen the design specifications for the Apple iPad.

|  |  |
| --- | --- |
| Weight excl. battery | 480g |
| Battery weight | 250g |
| Battery power | 25Wh |
| Battery type | Phosphate Li-ion = 100Wh/kg |
| Battery durability | Up to 10 hours (9 hours using GSM) |
| Display | 9,7” touch screen |
| Communication | Wi-Fi, USB, GSM, Bluetooth |

## Weight and power consideration

At present the Cobolt Li-ion batteries support the highest energy concentration of 160Wh/kg, and the design will therefore use this as a basis for creating the power architecture – this is not a design constraint, and should better technology emerge naturally it should be considered.

The safety aspect of using anything with this high a energy density will not be considered, as it is not a requirement and any problems regarding transportation and storage of the batteries falls to the main contractor.

As the requirements for the Dismounted POD’s critical operation time is 12 hours and it has a 10-12” display this means it requires more power and for a longer time than the comparable device. It also requires more back-light and communication. To accommodate these requirements it is estimated that a minimum of 400g of Cobolt Li-ion is required, i.e. 64Wh of power.

As the battery already consume half the permitted weight much consideration must be taken into the design of the frame and screen, as comparable device weighs 480g without battery, leaving only 120g extra for the added durability (rubber protection, harness, …) and communication. It is believed that this will be a major design risk and must be reduced early in the implementation process.

## Battery life and usage considerations

Even with 64Wh it is not realistic to run the backlight at 1000 candela for 12 hours, and also the communication is a limitation (see communication considerations). Therefore a definition of critical operations will be set up to guide the design:

|  |  |  |
| --- | --- | --- |
| **Usage** | **Description** | **Time** |
| Backlight at 1000cd\*1 | Maximum backlight – should be used under very bright light to see while temporarily in direct sunlight. | 3 hours |
| Backlight at 500cd\*1 | Normal backlight – should be used under normal lighting conditions. | 12 hours |
| Backlight at 100cd | Low backlight – should be used in poor lighting conditions. | >12hours |
| Active data transmission\*2 | By active data transmission is meant the actual transmission of the data by the physical layer (magnetic waves in one form or other). If new is received every minute and transmission takes 5 seconds (depending on amount and signal strength (retransmissions)) then the system can be operational for 60/5 \* 2 = 60 hours. Naturally any duration above 12 hours is not guaranteed. | 2 hours |

\*1 for numbers between 500 and 1000 cd please refer to the operational time chart for details.

## User interfacing consideration

Due to the requirement that the Dismounted COP must be used with gloves there are limitations on the accuracy of the touch, especially if moving about or in a volatile situation. The design focus must therefore be on simplicity and the system must be able to cope with incorrect or double presses. Furthermore, due to the very limited interfacing capabilities of a gloved hand, an administration mode may be beneficial, e.g. using the USB interface to attach a keyboard and then simply supplying the administrator with a command prompt. The administration mode is only for setup and utility functions, never for normal or critical operations.

The glove is considered to be a fingered glove and not a mitten.

## Communication considerations

As the main SiteWare trace server is designed to be a command center and be hosted in a large van or trailer it is not feasible to support the same forms of communication. For example the use of low frequency RF to communicate over long distances requires a large antenna and high power output, which is simply not possible. The SAT communication generally requires a larger antenna and has a higher power requirement than e.g. GSM, but it is a feasible communication media to build into the system.

The system will automatically choose the “best” communication media available based on bandwidth and power consumption.

## Security considerations

The system will use the communication media as-is, and not additional security (encryption) will be added.

# System architectural design

## System components

In Figure 2 may be seen the overall elements that comprise the system. These elements are displayed using the SysML notation for a block diagram.

The elements are further broken down in Figure 3, Figure 4, Figure 5, Figure 6, Figure 7, Figure 8 and Figure 9 until a level sufficient for detailed design is achieved. The interfaces are identified and will be described under the section about interfaces.

The individual elements will be described as is required to gain an understanding of the system in the sections following.



Figure 2: Element overview

### User display



Figure 3: User display inner block diagram

### CPU



Figure 4: CPU inner block diagram

### User input



Figure 5: User input inner block diagram

### Location



Figure 6: Location inner block diagram

### Power



Figure 7: Power inner block diagram

### Frame



Figure 8: Frame inner block diagram

### Communication



Figure 9: Communication inner block diagram

This paragraph shall:

a. Identify the components of the system (HWCIs, CSCIs, and manual operations). Each

component shall be assigned a project-unique identifier. Note: a database may be

treated as a CSCI or as part of a CSCI.

b. Show the static (such as "consists of") relationship(s) of the components. Multiple

relationships may be presented, depending on the selected design methodology.

c. State the purpose of each component and identify the system requirements and systemwide

design decisions allocated to it. (Alternatively, the allocation of requirements may

be provided in 5.a.)

d. Identify each component’s development status/type, if known (such as new development,

existing component to be reused as is, existing design to be reused as is, existing design

or component to be reengineered, component to be developed for reuse, component

planned for Build N, etc.) For existing design or components, the description shall provide

identifying information, such as name, version, documentation references, location, etc.

e. For each computer system or other aggregate of computer hardware resources identified

for use in the system, describe its computer hardware resources (such as processors,

memory, input/output devices, auxiliary storage, and communications/network equipment).

Each description shall, as applicable, identify the configuration items that will use the

resource, describe the allocation of resource utilization to each CSCI that will use the

resource (for example, 20% of the resource’s capacity allocated to CSCI 1, 30% to CSCI

2), describe the conditions under which utilization will be measured, and describe the

characteristics of the resource:

1) Descriptions of computer processors shall include, as applicable, manufacturer name

and model number, processor speed/capacity, identification of instruction set

architecture, applicable compiler(s), word size (number of bits in each computer word),

character set standard (such as ASCII, EBCDIC), and interrupt capabilities.

2) Descriptions of memory shall include, as applicable, manufacturer name and model

number and memory size, type, speed, and configuration (such as 256K cache

memory, 16MB RAM (4MB x 4)).

3) Descriptions of input/output devices shall include, as applicable, manufacturer name

and model number, type of device, and device speed/capacity.

4) Descriptions of auxiliary storage shall include, as applicable, manufacturer name and

model number, type of storage, amount of installed storage, and storage speed.

5) Descriptions of communications/network equipment, such as modems, network

interface cards, hubs, gateways, cabling, high speed data lines, or aggregates of these

or other components, shall include, as applicable, manufacturer name and model

number, data transfer rates/capacities, network topologies, transmission techniques,

and protocols used.

6) Each description shall also include, as applicable, growth capabilities, diagnostic

capabilities, and any additional hardware capabilities relevant to the description.

f. Present a specification tree for the system, that is, a diagram that identifies and shows the

relationships among the planned specifications for the system components.

## Concept of execution

This paragraph shall describe the concept of execution among the

system components. It shall include diagrams and descriptions showing the dynamic relationship

of the components, that is, how they will interact during system operation, including, as applicable,

flow of execution control, data flow, dynamically controlled sequencing, state transition diagrams,

timing diagrams, priorities among components, handling of interrupts, timing/sequencing

relationships, exception handling, concurrent execution, dynamic allocation/deallocation, dynamic

creation/deletion of objects, processes, tasks, and other aspects of dynamic behavior.

## Interface design

This paragraph shall be divided into the following subparagraphs to

describe the interface characteristics of the system components. It shall include both interfaces

among the components and their interfaces with external entities such as other systems,

configuration items, and users. Note: There is no requirement for these interfaces to be

completely designed at this level; this paragraph is provided to allow the recording of interface

design decisions made as part of system architectural design. If part or all of this information is

contained in Interface Design Descriptions (IDDs) or elsewhere, these sources may be

referenced.

### Interface identification and diagrams

This paragraph shall state the project-unique

identifier assigned to each interface and shall identify the interfacing entities (systems,

configuration items, users, etc.) by name, number, version, and documentation references, as

applicable. The identification shall state which entities have fixed interface characteristics (and

therefore impose interface requirements on interfacing entities) and which are being developed

or modified (thus having interface requirements imposed on them). One or more interface

diagrams shall be provided, as appropriate, to depict the interfaces.

### 4.3.x (Project-unique identifier of interface)

This paragraph (beginning with 4.3.2) shall identify

an interface by project-unique identifier, shall briefly identify the interfacing entities, and shall be

divided into subparagraphs as needed to describe the interface characteristics of one or both of

the interfacing entities. If a given interfacing entity is not covered by this SSDD (for example, an

external system) but its interface characteristics need to be mentioned to describe interfacing

entities that are, these characteristics shall be stated as assumptions or as "When [the entity not

covered] does this, [the entity that is covered] will ...." This paragraph may reference other

documents (such as data dictionaries, standards for protocols, and standards for user interfaces)

in place of stating the information here. The design description shall include the following, as

applicable, presented in any order suited to the information to be provided, and shall note any

differences in these characteristics from the point of view of the interfacing entities (such as

different expectations about the size, frequency, or other characteristics of data elements):

a. Priority assigned to the interface by the interfacing entity(ies)

b. Type of interface (such as real-time data transfer, storage-and-retrieval of data, etc.) to be implemented

c. Characteristics of individual data elements that the interfacing entity(ies) will provide, store, send, access, receive, etc., such as:

1) Names/identifiers

a) Project-unique identifier

b) Non-technical (natural-language) name

c) DoD standard data element name

d) Technical name (e.g., variable or field name in code or database)

e) Abbreviation or synonymous names

2) Data type (alphanumeric, integer, etc.)

3) Size and format (such as length and punctuation of a character string)

4) Units of measurement (such as meters, dollars, nanoseconds)

5) Range or enumeration of possible values (such as 0-99)

6) Accuracy (how correct) and precision (number of significant digits)

7) Priority, timing, frequency, volume, sequencing, and other constraints, such as whether

the data element may be updated and whether business rules apply

8) Security and privacy constraints

9) Sources (setting/sending entities) and recipients (using/receiving entities)

d. Characteristics of data element assemblies (records, messages, files, arrays, displays, reports, etc.) that the interfacing entity(ies) will provide, store, send, access, receive, etc., such as:

1) Names/identifiers

a) Project-unique identifier to be used for traceability

b) Non-technical (natural language) name

c) Technical name (e.g., record or data structure name in code or database)

d) Abbreviations or synonymous names

2) Data elements in the assembly and their structure (number, order, grouping)

3) Medium (such as disk) and structure of data elements/assemblies on the medium

4) Visual and auditory characteristics of displays and other outputs (such as colors,

layouts, fonts, icons and other display elements, beeps, lights)

5) Relationships among assemblies, such as sorting/access characteristics

6) Priority, timing, frequency, volume, sequencing, and other constraints, such as whether

the assembly may be updated and whether business rules apply

7) Security and privacy constraints

8) Sources (setting/sending entities) and recipients (using/receiving entities)

e. Characteristics of communication methods that the interfacing entity(ies) will use for the interface, such as:

1) Project-unique identifier(s)

2) Communication links/bands/frequencies/media and their characteristics

3) Message formatting

4) Flow control (such as sequence numbering and buffer allocation)

5) Data transfer rate, whether periodic/aperiodic, and interval between transfers

6) Routing, addressing, and naming conventions

7) Transmission services, including priority and grade

8) Safety/security/privacy considerations, such as encryption, user authentication,

compartmentalization, and auditing

f. Characteristics of protocols the interfacing entity(ies) will use for the interface, such as:

1) Project-unique identifier(s)

2) Priority/layer of the protocol

3) Packeting, including fragmentation and reassembly, routing, and addressing

4) Legality checks, error control, and recovery procedures

5) Synchronization, including connection establishment, maintenance, termination

6) Status, identification, and any other reporting features

g. Other characteristics, such as physical compatibility of the interfacing entity(ies)

(dimensions, tolerances, loads, voltages, plug compatibility, etc.)

# Requirements traceability

This paragraph shall contain:

a. Traceability from each system component identified in this SSDD to the system

requirements allocated to it. (Alternatively, this traceability may be provided in 4.1.)

b. Traceability from each system requirement to the system components to which it is

allocated.

# Notes

This section shall contain any general information that aids in understanding this

document (e.g., background information, glossary, rationale). This section shall contain an

alphabetical listing of all acronyms, abbreviations, and their meanings as used in this document

and a list of any terms and definitions needed to understand this document.

# A. Appendixes

Appendixes may be used to provide information published separately for

convenience in document maintenance (e.g., charts, classified data). As applicable, each

appendix shall be referenced in the main body of the document where the data would normally

have been provided. Appendixes may be bound as separate documents for ease in handling.

Appendixes shall be lettered alphabetically (A, B, etc.).

# Niv 1

## Niv 2

### Niv 3

#### Niv 4