

CSC 484 Final Team Project

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March 18, 2007

Introduction

CygNet Software develops enterprise scale SCADA (Supervisory Control and Data Acquisition) software solutions. CygNet provides critical functions for pipeline oil and gas operations, such as data acquisition, data displays, and data reporting.

In the field, “pumpers” drive trucks out to oil tanks to check their status. They may need to drain some of the oil out of the tank into the truck. They use a laptop equipped with CygNet software to record tank status details and to record any actions they have taken.

The oil tanks commonly exist in harsh, cold environments. The pumpers cannot type with gloves on, so they remove them temporarily while entering data on the laptop. Some pumpers have complained about using the laptops under such conditions.

Project Idea and Goals

We will create an alternative design (prototype) for the tablet PC for the “pumpers” users. Then we will do a usability evaluation of this prototype to determine the advantages and disadvantages versus the standard laptop interface. Our goal is to determine if the tablet

PC is a viable alternative for the pumpers.

Usability Requirements

The “interface” is the tablet PC based prototype. The “current interface” is a standard laptop with CygNet software. The “users” are members of the “pumpers” group, who have both domain knowledge and experience with existing CygNet software systems.

Efficiency Requirement

E1. For users who have already learned the tablet PC interface, the interface shall allow the user to complete common tasks in no more than the time it takes to complete them with the current interface. Some tasks may take more time, but the net sum of completing the most common tasks must be no more than with the current interface.

Safety Requirement

S1. The interface shall organize user controls such that user errors will be minimized. For example, an option to proceed will not be placed too close to an option to cancel.

S2. Should the user make a mistake, the interface shall allow the user to recover from it quickly.

S3. For critical operations, the interface shall ask the user for confirmation.

Utility Requirement

U1. The interface shall accommodate users with cold weather attire and gear. In particular, users want to operate the system without taking their gloves off as much as possible.

U2. The interface shall be convenient to carry around and use “on the move”. The shape of the interface shall be conducive to carrying, and not prone to dropping.

Learnability Requirement

L1. The core tasks of the interface shall be learnable in a week or less.

Memorability Requirement

M1. The interface shall support tasks in similar, consistent ways.

M2. For tasks involving many steps, the interface shall provide a way to help the users remember the steps.

Expert Interview

The answers below are paraphrased and reproduced from notes taken during an interview on March 15, 2007.

Efficiency Requirement E1

Interviewer: For the most common use cases, would the tablet PC interface take less time, more time, or about the same amount of time than the standard laptop interface?

Expert: Every task will take less time. In addition, some new tasks will be possible that aren't with a standard laptop.

Interviewer: Why would the tablet PC be more efficient?

Expert: Pumpers don't take the laptops out of their trucks when they go outside to do their work. This means they have to carry a notepad with them and take notes, or they have to memorize everything until they get back to the truck. If these use a notepad, then they will be doing double data-entry. If they use memorization, they could enter false information or forget to enter something.

Interviewer: What can they do that they can't with a standard laptop?

Expert: Take the tablet PC out of the truck and carry it with them. This would allow them to take notes as they are carrying out their inspections.

Safety Requirement S1, S2, S3

Interviewer: Are there any safety issues relating to the tablet PC interface?

Expert: No.

Utility Requirement U1

Interviewer: Pumpers have complained about taking their gloves off to type. Could pumpers possibly enter data on a tablet PC without taking gloves off?

Expert: It is plausible with a stylus, whereas

it's completely impossible with a standard laptop interface.

Utility Requirement U2

Interviewer: Do you think pumpers could reasonably carry the tablet PC with them when conducting their inspections?

Expert: Yes. They won't be outside of their trucks for an extended period of time (10 to 30 minutes). Durability will be important though. This mobility is the key benefit over the laptop, which may very well lead to increased data quantity and accuracy.

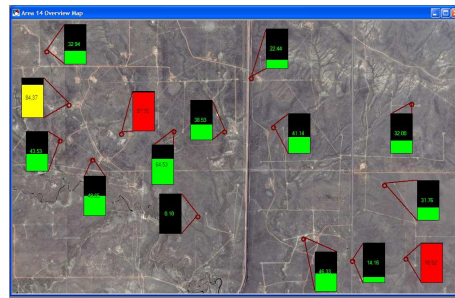


Figure 1: overview map for a specific tanker. Provides a high level overview of current volumes for various tanks in this region. Clicking on the "tank" brings the operator to the detail screen for that tank.

Learnability Requirement L1

Interviewer: How easy do you think pumpers could learn to use a tablet PC interface?

Expert: I think they could learn it easily. Using the stylus is more intuitive than typing. These tough guys are not good/fast typists. Many of them type using two fingers. This could potentially increase the quantity and accuracy of data entered.

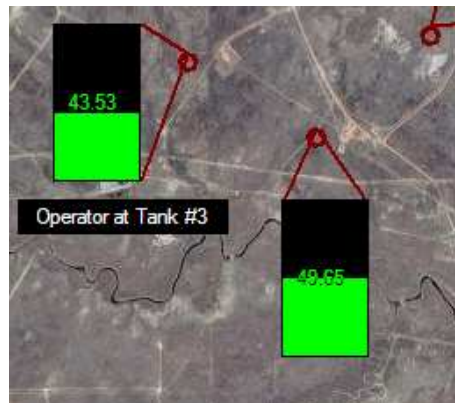


Figure 2: Once a pumper clicks on one of the tanks, it is indicated on the overview map that he is assigned there. Depending upon the screen design, this may not necessarily occur on the Pumper's overview map, but if the screens are also used by the corporate office, it can be used for current resource allocation.

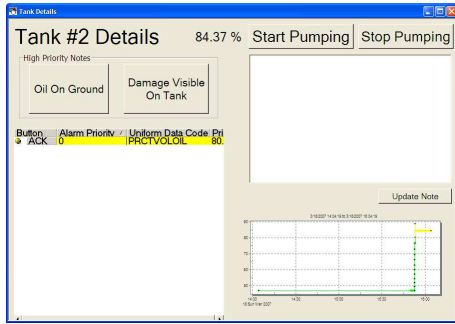


Figure 3: Detail screen for a specific tank. The top level indicates which tank is being viewed and the current volume level. Below that on the left hand side of the screen is for "critical" details. On the bottom, the Tanker can see that the percent volume of oil is in a warning state (the specific colors are actually configurable). Included are indicators for the Pumper to indicate to the main office any critical items. This is mainly to augment telephone communication and not to replace it. The right-hand side is for main the Pumper's main tasks; starting and stopping pumping, a "notes" box for them to record anything non-critical, and a history display of the tank level over the past two hours.

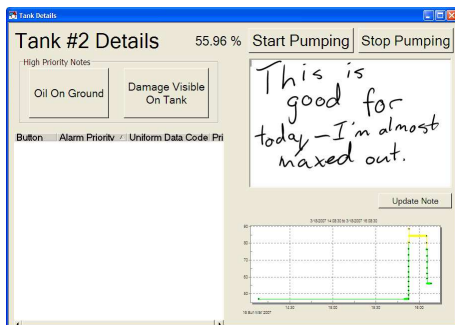


Figure 4: After having pumped some of the oil from the tank, the pumper has indicated why he's only drained the volume to only 56%.



Figure 5: This tank has been previously marked as having damage. This can be an indicator for the pumper to more thoroughly inspect the tank for any oil leaks beyond what he would normally do.



Figure 6: Detail screen for a critical alarm, in this case indicating that the pumper has seen oil on the ground. From here, the history for these actions can be seen ("SET" meaning that there's an oil leak, "NOT SET" meaning that the oil leak has been resolved), as well as being able to add any notes about the details of the oil leak to help cleanup crews.

EVALUATION FORM and RESULTS

We are evaluating the tablet-PC based prototype that we developed to identify pros and cons of replacing a laptop-based interaction paradigm for tankers working in the field.

Pumpers will be re required to use the system in the field while inspecting industrial infrastructure and pumping crude oil from tank batteries. Users will note their activity and actions taken as well as any aberrant conditions noticed while on site.

(E1 Requirement). How much time will it take for a pumper to complete tasks in the field with a tablet PC compared to with a truck-mounted laptop?

- Much longer
- Longer
- The same amount of time
- Less time**
- Much less time

Notes: Increased mobility may eliminate double data entry (see expert interview notes).

(S1, S2, S3 Requirements). Does the tablet PC interface present any safety concerns?

- yes
- no**

Notes: The safety considerations are the same as for the laptop interface.

(U1 Requirement). How well does the tablet PC interface support the pumpers in their cold weather attire?

- Much worse than with a laptop
- Worse than with a laptop
- The same as with a laptop
- Better than with a laptop
- Much better than with a laptop**

Notes: The ability to use the tablet PC while wearing gloves could significantly bolster the user's comfort. We recommend field tests to verify the interface works well with gloves.

(U2 Requirement). Does the tablet PC offer increased mobility to the pumpers during field inspections?

- worse mobility
- same mobility
- better mobility**

Notes: Our expert says this is the primary advantage to the tablet PC interface.

(L1 Requirement). How much training will it take to prepare a pumper to use a tablet PC vs. training a pumper to use a truck-mounted laptop to perform his or her duties?

- Much more
- More
- The same amount of time
- Less time**
- Much less time

Notes: Our expert believes the stylus interface is more intuitive and relies less on typing skills.

Compare the quality of data entered via tablet PC vs. using a laptop. Data entered by a pumper from a tablet PC would be of _____compared to data entered from a truck-mounted laptop.

- much lower quality
- lower quality
- the same quality
- higher**
- much higher

Notes: The expert says it may increase data quality because pumpers won't have to rely on their memory. Another reason is that pumpers

tend to be poor typists, and the stylus along with effective handwriting recognition software may improve data quality.

Quantity. Compare the amount of data entered via tablet PC vs. using a laptop

Pumpers would enter _____data when using a tablet PC compared to the amount entered from a truck-mounted laptop.

much less

less

the same amount of

more

much more

Notes: Pumpers don't like typing, especially if they have to remove their gloves in cold weather.

Conclusion

All of our usability tests were in favor of the tablet PC based design. There were some other non-usability based concerns, such as durability and cost. We recommend that CygNet conduct some further tests (especially in the field) to see if the tablet PC could benefit their business.