The Cargo Container Tracking System

Component Data and Technical Information report

Group 6

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http://koala.ece.stevens-tech.edu/sd2k01/grp6/

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I pledge my honor that
I have abided by the
Stevens Honor System

Transponder Control Unit-Component Integration

There are four major components that make up the transponder are the **Smart Card Interface Module, Transponder Power Supply, Transponder Control Unit (TCU),** and the **Wireless Interface Module.** Our primary concern will focus on development of the TCU as well as the interface module. The power supply solution will be determined once the other components become fully functional. The smart card interface will be developed based on the developments of the smart card integration group. Once their design and implementation has been finalized it will be incorporated into the transponder design.

Transponder Control Unit (TCU): The TCU is the heart of the transponder. It provides control and data handling capabilities to the unit. The desired implementation involves utilizing portable off the shelf components that can have some form over interconnectivity with the various other components within the transponder. It is desired that the TCU be based in part on a pocket PC. The pocket PC provides an environment that has control capacity as well as added connectivity to interface via expansion ports (PCMCIA and USB) with the various other components in the transponder. Additionally with regards to development of control applications, there are ample tools available for such tasks. Finally the pocket PC architecture is a standardized one. Its use and implementation world-wide has established its overall stability and reliability under various operating conditions.

Smart Card Interface Module: While not an immediate part of our component integration scheme. The smart card interface module design should be based on the following guidelines to maximize compatibility with the rest of the transponder system. First the module must be able to interconnect via USB to the TCU. Commercially available smart card reader are already existent that satisfy this requirement. Also, the smart card reader must be able to accept the type of smart card developed by the smart card team (eg. Contact, Contact-less, or Hybrid card types).

Wireless Interface Module: This is the key aspect of the transponder. This component will provide communications between the gate and the transponder and thusly, must be able to integrate with the other components. It is important to note that the generic term ”wireless” is used to describe the module. Depending on the analysis of various types technologies such as Bluetooth, RF radio, 802.11b and others a final decision will be made as to the technology implemented. Based on this, our design criteria call for this component to be in the form of PCMCIA card that will interface with the TCU. Currently all of these technologies are commercially available in the form required and can easily integrate with the TCU (pocket PC). It also is important to note that this component, depending on design choices could be integrated within the TCU. Currently there is a trend for Bluetooth technology to be combined with the pocket PC. If indeed we do implement this decision, the wireless interface module will still exist, but within the TCU, and not as a separate entity.

Gate Control Module-Component Integration

There are two basic components to the Gate control module, the **wireless interface module,** and the **gate control unit.** These two components, in addition to their various subcomponents integrate needed function necessary to implement the gate control module.

Gate Control Unit: The gate control unit is the heart of the gate reading system. In this application, because of its relative stationary and non-mobile position, the function of the unit can be satisfied by a typical generic personal computer. The PC has the software, as well as hardware capacity to perform the following tasks. First it must be able to interface with the wireless interface module in order to establish a connection to the transponder. Additionally it must provide a control mechanism to regulate the I/O between the gate and transponder. Second it must be able to link this information with various means of secondary storage both local and remote. This can be accomplished by means of internal secondary storage as well as outside WAN connections to various remote servers. Finally local control can be established by implementing local I/O. This implementation can be as simple as a keyboard and monitor

Wireless Interface Module: Similar to specifications of the Wireless Interface Module on the gate version differs in that it requires significantly more transmitting power to broadcast its signal. Because this module will be performing as a base station power output is critical to the overall efficiency and throughput of data exchanges. Currently their exist various types of RF, Bluetooth, and 802.11b base stations, all of which on the surface satisfy the initial constraints of the application. Overall depending on the wireless technology path that is chosen, further information and research will be needed to establish a clear solution.

Technical data on Bluetooth

Available are three classes:

Class 1
Radio power of 100mW (20dBm).
Range <100m (300ft)
Class 2
Radio power of 2.5mW (4dBm)
Range <20m (60ft)
Class 3 – most popular
Radio power of 1mW (0dBm)
Range <10m (30ft)

Bluetooth operates in the license free 2.4 GHz ISM spectrum (2.400–2.484 GHz) and uses frequency hopping spread spectrum (FHSS) – about 1600 hops/sec to minimize interference problems.
Maximum data communication (ACL) uses 72-bit access code, a 54-bit packet header and a 16-bit CRC code, in addition to the payload data. A data pocket stretches over five slots (DH5). A DH5 packet can carry 339 bytes, or 2712 bits of data. So, 2858 bits are sent on air for 2712 bits of information. Thus, the maximum base band data rate in one direction is 723.2 kb/s.

CONS:

Cannot be used for moving objects. Tests done on Class 3 Bluetooth.

> "An example of mobile nodes would be sports gear augmented with Bluetooth, e.g. bikes, skateboards, or a football. Based on the experienced mean discovery delay of 2221 ms, two Bluetooth devices traveling at a relative speed of 12.5 km/h (4.5 m/s) could already barley set up a connection before moving out of communication range again. The lengthy connection establishment effectively prevents the use of Bluetooth in fast-moving settings."
>
> http://www.inf.ethz.ch/vs/publ/papers/bt-experiences.pdf

Maybe by using Class 1 we would have enough time to set up a connection and transfer data.

RF Technical and Product Information

From RF GlobalNet I have found a product called SPEEDCOM SC5800. This is a digital radio system. The capabilities as per the description are "The SPEEDCOM T1/E1 through 4x T1/E1 products provide full-duplex, T1 or E1 point-to-point connections, using Direct Sequence Spread Spectrum, between two locations up to 25 miles apart."

They are saying that a link between two RF units will provide a platform for data transmission. This product I fear will be too powerful for our needs but sounds like it is in the correct direction. It does not however fit into the typical transponder-gate model we have been pursuing.

Other qualities of the system are "flexible solution. The SPEEDCOM SC5800 uses a modular design consisting of the data rate independent indoor unit combined with the 5.8 GHz outdoor unit. These full-featured systems are completely software configurable and support SNMP network management. For LAN-to-LAN connectivity, the SC5800 may also be configured to bridge or route IP via a wayside Ethernet channel"

This is good for the subscription business model because it allows private LAN to LAN connectivity as opposed to internet.

From a company called RF MicroDevices I have found a whole host of transceivers. A basic RF2510 VHF/UHF Transmitter can function as wireless data transmitter and as a low cost single frequency LO source. They function in the 300 to 1000 MHz range and have low power and resource characteristics which is good for us considering powering out system will be a challenge. There are other RF products from RF Micro that seem interesting.

Here is a really interesting one. A company called IFR is using their 1900-CSA (its an ANSI-136 PCS radio test set) to track wireless signals at the WTC to detect and locate wireless cell phone signals. This is exactly what we are trying to do only with transceivers in general not cell phones.

"The 1900-CSA basically acts as a base station, tracking wireless signals from the surrounding area. As each cell phone registers with the new "base station" (1900-CSA) special software captures the registration number and allows emergency response teams to connect this with a cell phone number.
These numbers are then reviewed against a list of victims' cell phone numbers in hopes there will be a match."