

Australian Bureau of Statistics Flow Control System for Census 2006

Australian Bureau of Statistics (ABS) chooses ASP Microcomputers to develop a custom solution to track Census forms in real time



Overview

A seven storey building in the heart of Melbourne is the location of the Australian Bureau of Statistics Data Processing Centre (DPC) for the 2006 census. Census night is on the 8th of August 2006. Information from this year's census will be released throughout 2007. Around 30,000 census officers are appointed to distribute and collect the forms to every household in Australia, and each is allocated a Collection District (CD). The eighteen pages which make up the census form are collected and sent back to the DPC in Melbourne for processing. Over 800 people are employed to manage and process the more than nine million completed census forms that are returned to the DPC. That's where ASP's solution starts.



Project Objective

Design an effective and secure real time census form tracking and reporting system for implementation at the Data Processing Centre in Melbourne.

Solution

- A real time barcode tracking system over a 802.11 wireless infrastructure across five levels of the DPC
- A barcode scanner program using ASP's middleware Rfolution!™
- Custom designed labels
- Four custom developed PC applications - Label Printing, Configuration, Enquiry & Reporting, and Receipt & Registration
- Data replication using Microsoft® SQL server

Benefits

- Exceeded security requirement
- Freedom to move across all floors to scan packs over a wireless infrastructure
- Wide range of reporting
- Ergonomic and light weight scanners
- Rapid application development
- Fast data transmission
- Instant pack location

Hardware and Software

- Denso BHT303BW portable barcode scanners with 802.11 radio frequency transmission
- Datamax i4208 label printer
- ASP Rfolution!™ middleware
- Linksys access points

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Danny McMahon
Manager
ABS – Flow Control System

Other Resources

Rfolution!™ middleware
www.rfolution.com

Australian Bureau of Statistics
www.abs.gov.au

Denso
www.denso-id.com.au

Datamax
www.datamaxcorp.com

More Information
casestudy@asp.com.au

A seven storey building in the heart of Melbourne is the location of the Australian Bureau of Statistics Data Processing Centre (DPC) for this year's census. Census night is on the 8th of August 2006.

The last census was in 2001, processing continued well in to 2002 which is around the time ABS started to plan for this census. Information from this year's census will be released throughout 2007.

Behind the scenes, conducting the census is an enormous and complex process.

Around 30,000 census officers are appointed, and each is allocated a Collection District (CD). These officers deliver the census forms to households before census night, then collect them afterwards.

The eighteen pages which make up the census form are collected and sent back to the DPC in Melbourne.

Over 800 people are employed to manage and process the more than nine million completed census forms that are returned to the DPC.

The challenge, once the forms have been delivered to the DPC, is to know where each of the forms are at any time within the four levels of storage and three processing floors.

ASP Microcomputers was chosen to solve this challenge.

The ASP Flow Control System (FCS) tracks each of the 110,000 boxes containing census materials using barcodes.

ASP's solution comprises:

- A real time barcode tracking system over a 802.11 wireless infrastructure across the five levels of the DPC.
- A barcode scanner program using ASP's middleware RFolution!™

- Four custom developed PC applications.

Data Replication Solves Security Concerns

Security was of the utmost importance for the ABS, and this was achieved through data replication and a hardware firewall.

A new separate wired network was installed to connect the wireless access points (for the RF terminals) to a PC running ASP's RFolution!™ control software and an SQL database. This "untrusted" network was then connected to the existing "trusted" ABS network using a hardware firewall, configured to pass only database replication information.

On the trusted ABS network, a PC was set up to host a replicated copy of the SQL database, and this database is the one accessed by the PC application programs used by ABS staff for management reports and tracking information.

No actual census details or identifying information of any kind are passed over the wireless network, and because of the hardware firewall, it is not possible to gain access to the ABS network via the wireless network.

PC Programs

ASP developed four PC application programs for this system - Label Printing, Configuration, Enquiry & Reporting, and Receipt & Registration. All programs were written in Borland C++. These programs are installed on as many ABS PC's as required.

Census forms arrive at the DPC

The census forms arrive at the DPC in packs, marked with their "Collection District" (CD) number. When the packs arrive, various sorting and secondary checks are performed, and packs are consolidated with each pack containing about 100 forms. All packs from a

particular Collection District are referred to as a CD.

A CD pack must move throughout the processes together and cannot be separated.

A custom Receipt & Registration program is used to enter the CD pack details into the system, allowing tracking to begin.

A custom Label Printing program, together with a Datamax label printer, is then used to label each CD pack. This program prompts the user to enter the CD pack barcode number, and the number of labels to print, and the software then uses this and the information entered with the Receipt & Registration program to create the labels.

Each label also shows how many packs are in the CD, and approximately how many forms are in each pack, with this last item handwritten on the label.

The barcode labels are pre-printed with coloured bars on the left and right edges, to indicate the state or territory of origin of the contents of the pack that the label is attached to, as a visual aid to ABS staff.

The barcode label content and format was designed to allow a high level of checking without the scanner needing to consult the database. For example, scanning one pack of a CD automatically provides the scanner with information on how many packs are in the CD, and which particular pack of that total has been scanned.

After the labels have been affixed, the CD packs are then able to begin the journey through a series of ABS processes

- Receipt & Registration
- Precapture, Guillotining
- Data Capture
- Balancing
- Final Store

- Dead Store
- and Destruction

and in some cases, CD packs have to go through a process more than once.

Because of the volume of CD packs, each process has one or more stores where packs await processing or transfer to another store. The system allows temporary stores to be created and removed as required, depending on the volume of packs, and any bottlenecks in the processing.

Each store has two sections – an “In Store”, where CD packs are placed when they are booked into a store, and an “Out Store”, where CD packs are placed prior to being moved to another store. Each store is uniquely identified with a barcode label, and is identified by that barcode as an “In Store” or an “Out Store”.

Scanner Operation

CD packs arrive at an In Store to await processing. Once the processing is complete, CD packs are moved to the Out Store, to await transfer to the next store.

There can be up to 15,000 pack movements per day. This is calculated by each of five processes having a throughput of 1000 CD packs per day, with CD's consisting of an average of 2.5 packs.

CD packs are moved via trolleys that may hold up to 30 packs.

The scanner initially displays a Main Menu, from which the operator can select an “In Movement” (packs being brought from another place to this store) or an “Out Movement” (packs being taken from this store to another place) operation.

Once the operation is selected, the scanner operator will then scan or enter a staff number that identifies them to the system, and then scan or enter the store barcode. The barcode scanner checks to make sure that the operator has scanned an “In Store” barcode if they have selected an “In Movement” operation, or vice-versa.

An error message is displayed if an incorrect barcode is scanned for the selected operation.

The operator is then prompted to scan each CD pack on the trolley. From the barcode label, the scanner identifies the "base" CD number for the pack, and displays a message indicating how many packs are in that overall CD, and how many more packs need to be scanned for that complete CD.

If an unrecognised or invalid barcode is scanned at the "CD Pack" prompt, the scanner displays an error message.

The system is field-programmed with the order of the processes so that it will not allow a CD pack to be moved to a store if the CD pack has not already been through the required earlier processes.

The system allows particular CD pack numbers to be flagged (by administrative staff, at a PC), and when any pack in that CD is scanned, the scanner will display a pre-defined message.

The system allows individual staff to be assigned a specific Supervisor, and will allow a small number of pre-defined messages to be sent by a staff member to their Supervisor via the scanner. These messages are defined at the PC.

All operators can perform a search by CD pack number from the barcode scanner if they need to locate a particular CD pack.

Management Functions

The Enquiry & Reporting program allows a variety of queries and reports to be conducted on the collected data. These reports include:

- Display the location history of a particular CD pack
- Display the number of CD packs located in a particular store
- Display a list of the CD packs located in a particular store, including the time and date that they were checked into that store, sorted in time and date order
- Total movements per process by a given date range
- Total CD packs completed by process by state, including number of forms per CD pack
- Total CD packs remaining by process by State, including number of forms per CD pack.

Supervisors can also use this program to tag specific CD packs, and when a scanner operator scans a tagged pack, a pre-defined message is displayed on the scanner to advise the scanner operator to contact the supervisor about the CD pack.

Scanner operators are also able to send pre-defined messages to their supervisor, who will receive the messages via the Enquiry & Reporting program.

Danny McMahon, Manager ABS – Flow Control System said, "Throughout the development process of the flow control system there have been challenges for ASP. In every case their team has been able to provide a solution to any issue that we have presented them.

This system is critical to the day-to-day operations of the DPC and ASP have delivered a system to meet our stringent security requirements, complex movement rules for the various pack types, management and reporting facilities all in a user friendly intuitive solution.

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