ELECTRONIC CANE CONSIGNMENT AT ISIS MILL

By

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Abstract

CANE CONSIGNMENT IS a critical link in the delivery of cane from the field to factory. Traditionally, this has occurred in paper form, completed by the haul-out driver, passing through several sets of hands before finally reaching the sugar mill weighbridge. The entering of consignment information into the mill payment system typically occurred as a just-in-time system, where cane was delivered to the yard and tickets eventually made their way to the weighbridge clerk for manual entry into the system. The direct cost of sugar cane transport is one of the largest unit costs of the manufacturing sector of the industry. Capital and operating cost components of cane transport are large. Under-utilisation of cane bins or delays in locomotive movements can add significantly to these costs. There are also indirect costs associated with cane transport and cane supply delays at the sugar factory. Cane deterioration losses when cane is not scheduled to pick up in a timely manner, as well as delays to harvesting caused by insufficient empty bins at the rail siding or truck pad, can also add significantly to stakeholder costs. Electronic cane consignment allows information to be relayed to a number of stakeholders immediately the cane is placed into the cane bin. This provides almost live information about haul-out deliveries to truck pads and cane railway sidings. This in turn allows for scheduling adjustments to both road and rail systems, reduces cut to crush delays, and avoids having locomotives and cane bins under-utilised. Due to the electronic consignment data being subject to a level of primary validation during field entry, the accuracy level of the information is usually superior to the paper ticket alternative. As a result, factory efficiency is improved by eliminating unnecessary stops due to bad or incorrect information and significantly reduces the time required by weighbridge personnel to correct errors in consignment data entry. Consequently, this role has been rationalised to incorporate both the duties of the traffic office and weighbridge.

Introduction

This paper reports on the objectives of electronic cane consignment and the adoption by stakeholders. It gives a general introduction to the system development stages and provides a brief explanation of the two main components, the field devices and the main server application. Obviously both of these elements are critical to the overall operation of the system.

The paper will conclude by exploring future possibilities that have been made available by the up-to-date knowledge of the raw product stock levels. This information may create new possibilities for some just-in-time decision making.

System design and considerations

Consigning cane electronically required a change in the mindset of the people involved in the harvesting of the crop. Their primary consideration is cutting the crop and transporting the cane to rail sidings or load pads. Recording the details of these bins, although important for payment, is to some degree secondary. It is for this reason that a replacement to the hand written consignment tickets had to be easy to use and very flexible.

A major consideration for this project to be feasible and cost-effective was that the 3G/4G signal reception had to be reliable over a significant section of the growing area. With the explosion in the usage of mobile phones over the last few years, a great deal of resources has been invested by the mobile phone carriers. This has had the combined effect of increasing the coverage and substantially reducing the cost of providing this service, specifically for data transfer.

Even with this huge investment in mobile infrastructure, reception in all locations cannot be guaranteed, as most mobile phone users would appreciate. It was for this reason that the units remain portable and that bin consignments can be stored should no reception be available at the current location. The bin details are entered as they are harvested and displayed as Queued. The user can then move to a location where there is a signal and can then transfer these consignment details.

The other consideration was the cost of the field device. Five years ago, the cost of these devices was significant. Typically, a unit used for this specific application was bespoke built. This had the undesirable effect of being quite expensive and very specific in its use, and with restricted flexibility. But with electronic tablets and smart phones becoming just another commodity, the price per unit has dramatically decreased. The remote device of choice for this application has been an Android Tablet (usually Samsung).

Entry validation

In order to ensure the integrity of the consignment, the entry data are verified against the farm and block configuration details stored on the server. Before commencing harvesting, the contractor has the option of downloading this field information relating to the specific harvesting group. This may be carried out weekly or more regularly depending on volatility of the stored farm details.

Reporting

Consignment history

This option transfers details of each consigned bin to the server, which consolidates this into a PDF report. This report is then emailed to the harvesting contractor and grower. This is designed to act as a receipt of the consignments, essentially to replicate the carbon copy of the hand written ticket books.

Processed delivery details

Once a consignment has been received and processed at the mill, a summary of the weights and analysis details for each delivery can be requested by the harvesting contractor (refer to Fig 5).

This includes the following details:

- Total net weight of a specific consignment with the number of bins associated with this delivery
- Cane analysis details provided by the online near infrared cane analysis system, e.g. fibre, ash/mud levels (CCS can also be provided if authorised)

Goals

Eliminate paper tickets

Disadvantages with paper tickets:

- Consignment details can only be validated when entered at the mill.
- Tickets pass through several hands and can be lost or damaged.
- Can be difficult to read by the time they arrive at the mill.
- The number of full bins is only really known once they arrive in the mill yard.

Advantages of electronic consignment:

- Information is validated at the time it is entered.
- It is sent directly to the mill server, the sender receives notification that it has arrived at the mill.
- The consignment data are clear and concise.
- Total number of bins harvested from each contractor is known at all times.
- Correcting consignment mistakes, for example incorrectly consigning bins with a duplicate number.

Stock levels in the field

A significant advantage provided by cane consigned remotely using telemetry is knowing what stock levels are available in the field as they are harvested, this provides these stock levels in real time. By having this information in real time, this is a management tool that can be invaluable for decision making, particularly when determining maintenance stops. For future applications relating to transport efficiencies, knowing the field stocks at all times will be a significant factor.

Implementation

Field

Each harvesting group was supplied a Samsung Galaxy Tab Active android tablet (Figure 1). This tablet was chosen due to its IP67 environmental sealing rating and the brightness of the screen when viewed in direct sunlight. The tablets were mounted chiefly in haul-outs with a RAM mount cradle designed specifically for the Galaxy Tab Active that held the units securely and also provided a constant 12V power supply (Figure 2).

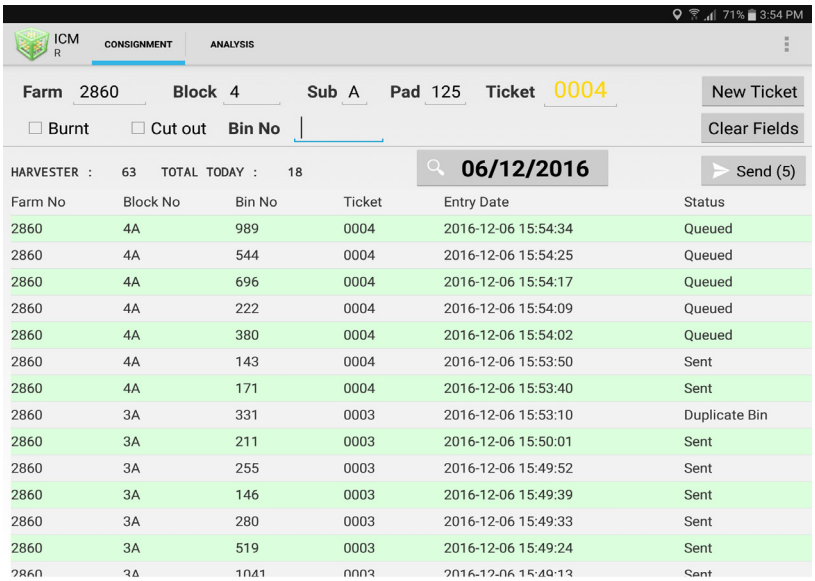
Fig. 1—Remote device in field use.

Fig. 2—Remote device in cradle.

The tablets are remotely managed which allows the user to be remotely supported and application updates to be pushed out without physically visiting each harvesting group.

Each tablet contained a 4G SIM card that was part of a shared data pool for all units. Data usage for a large harvesting group was minimal (on average 100MB/month).

The consignment entry section allows the harvesting contractor to enter and send full bin information to the mill. All farm fields are validated on entry and only the bin number needs to be entered for subsequent bins from the same block. All the day's transactions are listed together with their transmission status (Figure 3). On send, a success/fail message is displayed (Figure 4).



Farm No	Block No	Bin No	Ticket	Entry Date	Status
2860	4A	989	0004	2016-12-06 15:54:34	Queued
2860	4A	544	0004	2016-12-06 15:54:25	Queued
2860	4A	696	0004	2016-12-06 15:54:17	Queued
2860	4A	222	0004	2016-12-06 15:54:09	Queued
2860	4A	380	0004	2016-12-06 15:54:02	Queued
2860	4A	143	0004	2016-12-06 15:53:50	Sent
2860	4A	171	0004	2016-12-06 15:53:40	Sent
2860	3A	331	0003	2016-12-06 15:53:10	Duplicate Bin
2860	3A	211	0003	2016-12-06 15:50:01	Sent
2860	3A	255	0003	2016-12-06 15:49:52	Sent
2860	3A	146	0003	2016-12-06 15:49:39	Sent
2860	3A	280	0003	2016-12-06 15:49:33	Sent
2860	3A	519	0003	2016-12-06 15:49:24	Sent
2860	3A	1041	0003	2016-12-06 15:49:13	Sent

Fig. 3—Consignments showing status.

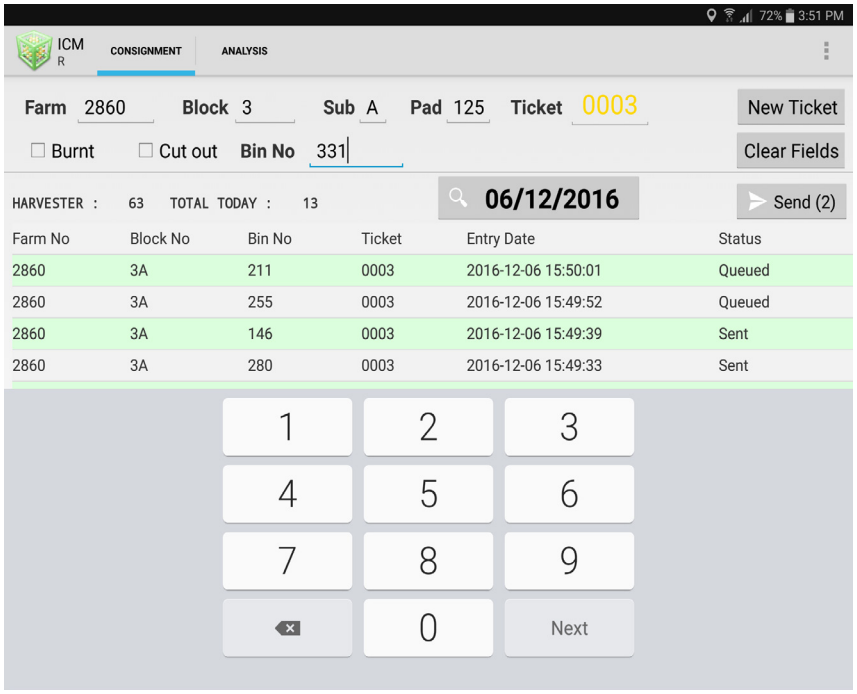
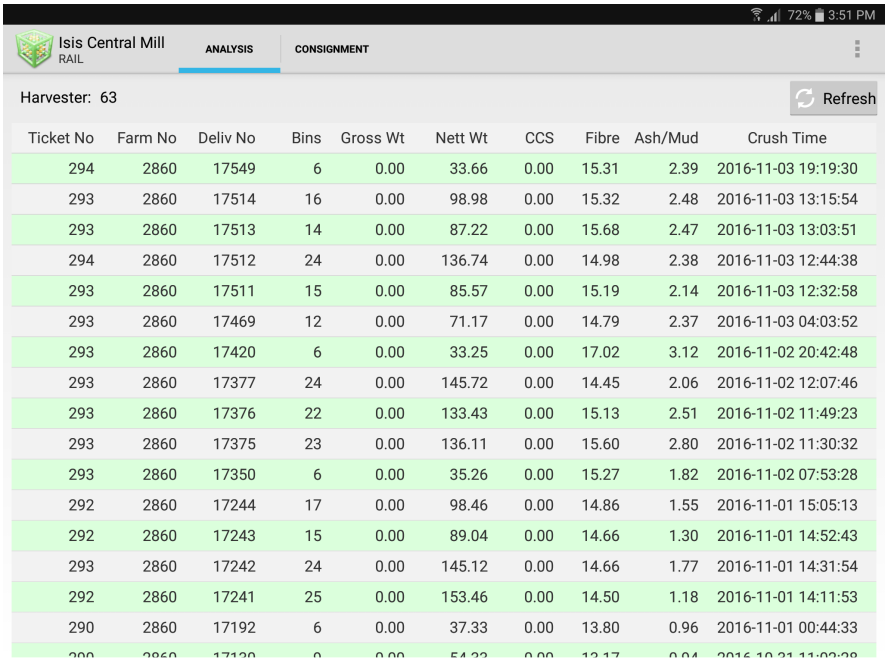


Fig. 4—Data entry for Ticket 0003.

The analysis query screen (Figure 5) gives a view of all cane consigned by the harvesting contractor for that day as soon as the mill has processed these deliveries. This is a real time view of the analysed results for each consignment.



Ticket No	Farm No	Deliv No	Bins	Gross Wt	Nett Wt	CCS	Fibre	Ash/Mud	Crush Time
294	2860	17549	6	0.00	33.66	0.00	15.31	2.39	2016-11-03 19:19:30
293	2860	17514	16	0.00	98.98	0.00	15.32	2.48	2016-11-03 13:15:54
293	2860	17513	14	0.00	87.22	0.00	15.68	2.47	2016-11-03 13:03:51
294	2860	17512	24	0.00	136.74	0.00	14.98	2.38	2016-11-03 12:44:38
293	2860	17511	15	0.00	85.57	0.00	15.19	2.14	2016-11-03 12:32:58
293	2860	17469	12	0.00	71.17	0.00	14.79	2.37	2016-11-03 04:03:52
293	2860	17420	6	0.00	33.25	0.00	17.02	3.12	2016-11-02 20:42:48
293	2860	17377	24	0.00	145.72	0.00	14.45	2.06	2016-11-02 12:07:46
293	2860	17376	22	0.00	133.43	0.00	15.13	2.51	2016-11-02 11:49:23
293	2860	17375	23	0.00	136.11	0.00	15.60	2.80	2016-11-02 11:30:32
293	2860	17350	6	0.00	35.26	0.00	15.27	1.82	2016-11-02 07:53:28
292	2860	17244	17	0.00	98.46	0.00	14.86	1.55	2016-11-01 15:05:13
292	2860	17243	15	0.00	89.04	0.00	14.66	1.30	2016-11-01 14:52:43
293	2860	17242	24	0.00	145.12	0.00	14.66	1.77	2016-11-01 14:31:54
292	2860	17241	25	0.00	153.46	0.00	14.50	1.18	2016-11-01 14:11:53
290	2860	17192	6	0.00	37.33	0.00	13.80	0.96	2016-11-01 00:44:33

Fig. 5—Production details of processed consignments.

Figure 6 is a screen shot of the field entry screen, part of the electronic cane consignment used by Isis. This illustrates how all of the bins that have been consigned from the field using telemetry, are listed.

The user has options to highlight a row, view details and has the facility to edit or remove entries from the field queue. Duplicate bins are displayed in red and is the result of a harvesting group incorrectly entering a bin number that conflicts with a correctly entered bin number.

FIELD					
Ticket No.	Bin No.	Farm	Block	Side	Harvest Time
630295	621	2860	11A	125	Sun 17:08
151457	621	7105	1A	7010	Mon 04:54
510212	901	1060	7C	57	Sun 14:33
510212	1795	1060	7C	57	Sun 14:33
510212	450	1060	7C	57	Sun 14:33
510212	1876	1060	7C	57	Sun 14:34
510212	326	1060	7C	57	Sun 14:34
510212	195	1060	7C	57	Sun 14:34
510212	1810	1060	7C	57	Sun 14:34
510212	1489	1060	7C	57	Sun 14:34
510212	1799	1060	7C	57	Sun 14:34
510212	1480	1060	7C	57	Sun 14:34
510212	1197	1060	7C	57	Sun 14:34
510212	1827	1060	7C	57	Sun 14:34
510212	914	1060	7C	57	Sun 14:34
510212	1828	1060	7C	57	Sun 14:34
510212	145	1060	7C	57	Sun 14:34
510212	1587	1060	7C	57	Sun 14:35
510212	494	1060	7C	57	Sun 14:35
510212	14	1060	7C	57	Sun 14:35
630295	1688	2860	11A	125	Sun 15:59
630295	1935	2860	11A	125	Sun 15:59
630295	243	2860	11A	125	Sun 15:59

Fig. 6—Field entry data.

Results

In the 2015 season, four of the remote entry devices were trialled on some of the larger harvesting groups. During this trial period, as a result of experience gained by both the user in the field and mill staff, the remote field application and the main service process on Cane Receivals platform were extended and refined.

Following a successful trial in the 2015 season, it was decided to deploy 49 units in the field for the 2016 season, with 100% of consignments being transferred electronically.

- Very little support was required from either the mill staff or the software developers.
- The accuracy of the consignment information improved significantly.
- Users of the devices in the field adapted very quickly to this change in this consignment method that had traditionally been in place for many years.

Future considerations

Within the cane delivery cycle, there are multiple segments involved in transporting the cane and accurately recording the details of the consignments; this paper provides the details of

automating just one of these stages. A second paper (Ryan and McNair, 2017) will expand on how knowledge of the consignment details in real time has made it possible to fully automate the receiving and processing areas as the cane arrives at the mill yard.

In the future, additional stages within this delivery cycle will be identified, which may contribute to the improved efficiency of this critical section of the overall manufacturing process.

Conclusions

The roll out and general acceptance by the harvesting contractors was quite high, with very few appearing to experience any significant problems adapting to quite a different method of cane consignment. In fact, some groups actively requested to participate in the trial.

The signal coverage for the mobile network exceeded our expectations; based on feedback from the users, it would be between 75% and 80% of the growing area.

There was also a marked improvement in the reliability and accuracy of the consignment details compared with the paper ticket option. Cut times were also more reliable due to the bin consignments being time stamped as they were entered.

It was considered by most participants in this exercise that the transition from hand written tickets to electronic consignment proceeded with minimal disruption.

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