final report

Project code: P.PSH.0625

Prepared by: Gavin Inglis

Machinery Automation and Robotics

Date published: February 2014

PUBLISHED BY

Meat & Livestock Australia Limited
Locked Bag 991
NORTH SYDNEY NSW 2059

Red Meat HMI iPad APP

This is an MLA Donor Company funded project.

Meat & Livestock Australia and the MLA Donor Company acknowledge the matching funds provided by the Australian Government to support the research and development detailed in this publication.

Abstract

Increased adoption of MAR robot systems developed for the red meat industry has driven a need for improved technical support and management mechanisms. As a result MAR have developed three iPad APP's aimed at providing support to management and maintenance staff to enable them to more successfully keep their systems functioning with minimum assistance from MAR service. The APP's developed are:

- Red Meat Remote – suitable for enabling management to monitor the robot system remotely.
- Red Meat Service Tool – enables maintenance staff to report issues and send to MAR via email complete with video, photos and faults logs from the robots.
- Red Meat HMI APP – allows maintenance staff to constantly monitor the cell and quickly identify any issues.

Executive Summary

Improved technical support is key for robot systems in the production critical red meat industry for the following reasons:

- Systems are often located in country areas which results in response delays
- Reduce service and breakdown costs (call outs to site by MAR)
- Any downtime leads to loss of production
- Many plants operate 2-3 shifts requiring service out of normal business hours
- Plant maintenance staff have minimal experience in fault finding robot systems
- Prediction of system faults before they occur
- Improving performance of existing and future systems
- Improving confidence and perception within the industry that robots can operate without downtime

MAR have developed three APP's:

- Red Meat Remote – suitable for enabling management to monitor the robot system remotely. It has achieved its objectives by providing a remote interface to view a web cam mounted on site as well as simple production status information allowing the iPad operator to view critical production data and machine operations.
- Red Meat Service Tool – enables maintenance staff to report issues and send to MAR via email complete with video, photos and faults logs from the robots.
- Red Meat HMI APP – allows maintenance staff to constantly monitor the cell and quickly identify any issues.

MAR has received positive feedback from GMP and also at the recent Red Meat Technology Update Day held at MAR. MAR plan for further Roll Out and development of iPad APPs in the Red Meat Industry, targeting processors with MAR Robot installation initially.

Contents

1 Background

Increased adoption of MAR robot systems developed for the red meat industry has driven a need for improved technical support and management mechanisms.

Improved technical support is key for robot systems in the production critical red meat industry for the following reasons:

- Systems are often located in country areas which results in response delays
- Reduce service and breakdown costs (call outs to site by MAR)
- Any downtime leads to loss of production
- Many plants operate 2-3 shifts requiring service out of normal business hours
- Plant maintenance staff have minimal experience in fault finding robot systems
- Prediction of system faults before they occur
- Improving performance of existing and future systems
- Improving confidence and perception within the industry that robots can operate without downtime

This project aims to support and assist with the development, adoption and commercialisation of automation within the Red Meat Industry by providing useful production and maintenance tools.

2 Project Objectives

The project will develop the following 3 iPad APPS:

- ROC QA tool – Excel Tool (Pre iPad APP development work)

  This excel tool will be developed prior to any APP development, the purpose being to enable the workings of a possible APP to be defined and tested on site.

- Red Meat Remote

  This APP will provide a remote interface to view a machine situated web cam and simple production status information allowing the iPad operator to view critical production data and machine operations.

- Red Meat Service Tool

  This APP will provide a tool to assist the reporting of any machine troubles or enhancements via use of a service request form that allows photos and/or video footage to be embedded along with data from the machine/robot at the time of entry. His data will include specific information such as fault logs and production data

- Red Meat HMI

  This APP will provide a remote Human Machine Interface (HMI) or SCADA type interface to view machine robot and PLC status allowing the iPad operator to view critical production and machine maintenance data.

3 Methodology

The objectives will be achieved by completing the following milestones:

Milestone 1:
1.1 Develop specification and develop tool in MS Excel or similar. Successful demonstration to MLA and Greenleaf.

1.2 Develop of MS excel or similar input and record keeping platform (included in above).

1.3 Install at GM Scott and trial for one month. Report to MLA on usage and feedback.

Milestone 2:
2.1 Develop specification, APP software and machine interface programming and communications setup. Successful demonstration to MLA at MAR.

2.2 Software development for APP

2.3 Machine interface programming and communications setup

2.4 Setup and Testing of APP at MAR

2.5 Setup & test machine interface, communications and APP at GMP. Trial for one month. Report to MLA on usage and feedback

2.6 Setup and Testing of APP at Red Meat Facility

2.7 Reports and documentation outlining success and functions to support automation in Red Meat

Milestone 3:
3.1 Develop specification, APP software and machine interface programming and communications setup. Successful demonstration to MLA at MAR.

3.2 Software development for APP.

3.3 Machine interface programming and communications setup.

3.4 Setup and Testing of APP at MAR.

3.5 Setup & test machine interface, communications and APP at GMP. Trial for one month. Report to MLA on usage and feedback on this and all previous apps.

3.6 Setup and Testing of APP at Red Meat Facility.

3.7 Reports and documentation outlining success and functions to support automation in Red Meat.

Milestone 4:
4.1 Develop specification, APP software and machine interface programming and communications setup. Successful demonstration to MLA at MAR.

4.2 Software development for APP.

4.3 Machine interface programming and communications setup.

4.4 Setup and Testing of APP at MAR.

4.5 Setup & test machine interface, communications and APP at GMP. Trial for one month. Report to MLA on usage and feedback of this and all previous apps.

4.6 Setup and Testing of APP at Red Meat Facility.

4.7 Reports and documentation outlining success and functions to support automation in Red Meat.

4 Results and Discussion

4.1 Milestone 1

The MS Excel tool was developed to provide GM Scott with a structured and easy to use MS Excel spread sheet to record the required QA data. The sheet allows the QA person to record the accuracy of the Chump, Leg and Loin cuts in mm as well as providing columns for recording the numbers of ribs on each side of the shoulder cut. Space for the recording of the time the sample was taken as well as room for comment on each sample is provided. The accuracies recorded in mm are averaged for each cut and rib counts are be converted to % for:

- +/- half a rib
- +/- one rib
- > one rib.

The figure below is a sample of the sheet as used at GM Scott. The information gathered was generally considered to useful. However due to the fact that it is a manual system and considered a 'hassle' to manually record the data on the boning room floor and then have to manually input it into a computer back in the office, it has not been used as an ongoing recording method. Adaption of this spreadsheet into an iPAD Application, where the data could be directly recorded on the iPAD while the operator is on the Boning Room Floor is seen as a great advantage here.

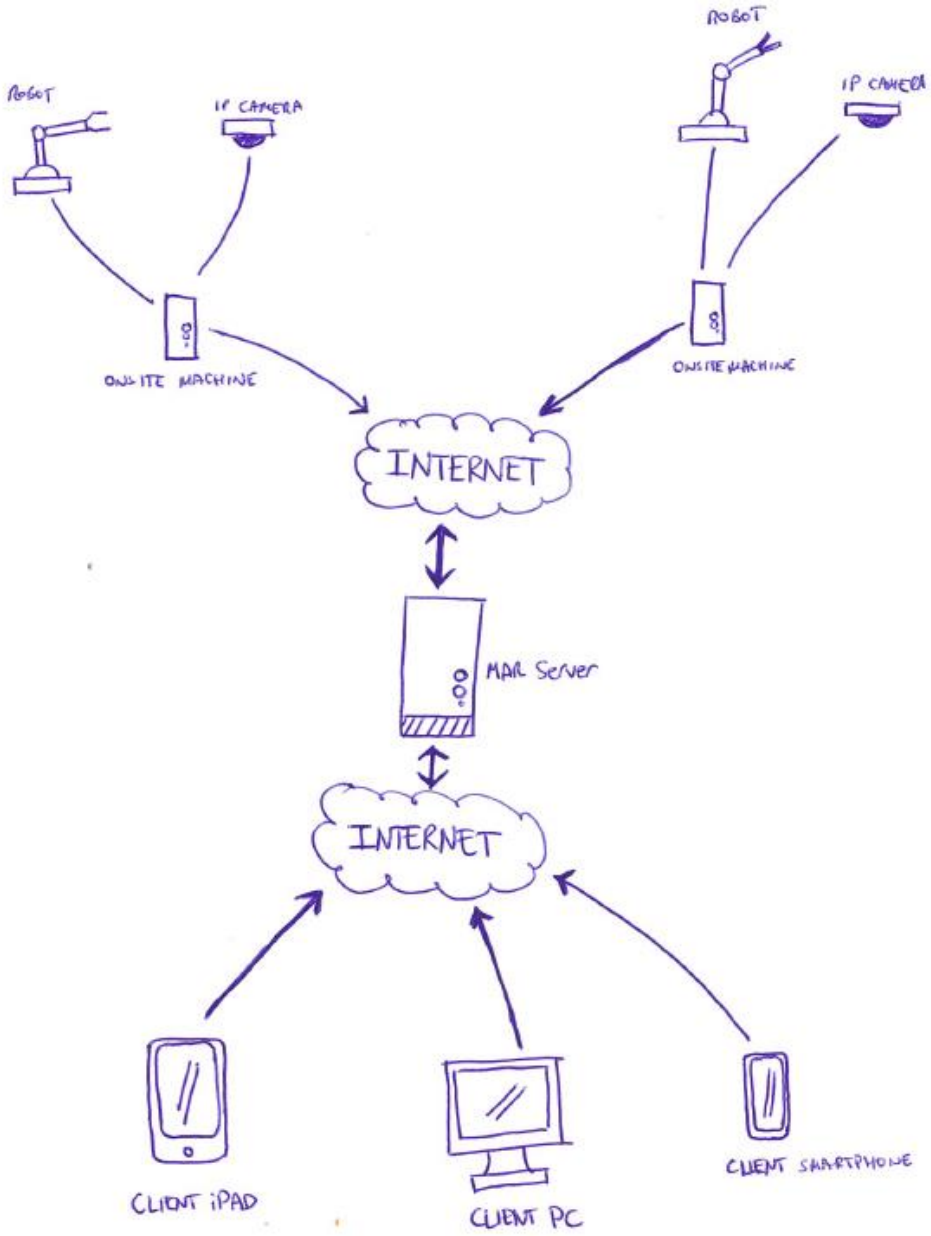
Station Name:	ROC 450			Date:	25.3.13
GEMSCOTT				QA Responsible:	Britta Doolan
	GM Scott Pty Ltd			Supervisor:	Matthew Flynn
	572 Temora Road, Cootamundra, NSW 2590, Australia			Senior Manager:	John O'loughlin

Cut #	Time	Chump	Leg	Loin	Shoulder LH	Shoulder RH	Comments
Sample 1	*7:45*	0mm	2mm	0mm	4	4	
Sample 2	*7:45*	1mm	0mm	0mm	4	4	
Sample 3	*7:45*	1mm	0mm	0mm	4	4 1/2	
Sample 4	*7:46*	0mm	9mm	3mm	5	4	
Sample 5	*7:46*	3mm	6mm	3mm	2	3	
Sample 6	*7:46*	2mm	3mm	5mm	3	4	
Sample 7	*7:46*	0mm	3mm	1mm	4	4	
Sample 8	*7:47*	3mm	0mm	3mm	4	4	
Sample 9	*7:47*	2mm	0mm	2mm	5	4 1/2	
Sample 10	*7:47*	1mm	0mm	4mm	4	4	
TOTAL COUNTS		**10**	**10**	**10**	**10**	**10**	
AVG		**1mm**	**2mm**	**2mm**	**4**	**4**	
% +/- 1/2 Rib							
% +/- 1 Rib							
% +1 Rib							

4.2 iPad APP's Specification and Software Development

4.2.1 Red Meat Remote APP

The Red Meat Remote iPad APP will allow clients and MAR service personnel to remotely monitor client robotic systems via the Web. The APP will display a live video stream of the client machine, as well as the current status of the attached robots. As the below diagram shows the on-site PC interfaces with the robot/s and IP camera which in turn interfaces via the internet with a Server at MAR allowing this to occur.



The APP will have the following features:

- It will allow the clients to log onto the MAR monitoring system from any device (PC, tablet, smart phone)
- It will display a real-time video stream of the client's on-site system
- It will display the current status of any connected device
- It will allow access and viewing of multiple robots and cameras (as installed on-site)
- Access will be restricted to MAR Remote sites relevant to client
- It will give the client the ability to change/restore password
- It will interface with on-site client machines via MAR Remote machine

4.2.2 Red Meat Service Tool APP

The Red Meat Service Tool APP for iPad will be based upon the previously developed MAR Service Tool APP, however will be enhanced to provide functionality to access data from the machine/robot system rather than relying upon manually input data only.
The existing Service tool APP provided a tool to assist the reporting of any machine troubles or enhancements via use of a service request form that allows photos and/or video footage to be embedded. This enables this information to be directly sent to MAR's service department for action and response.
The above function will still exist; however when a service request is actioned via the iPad, The new Red Meat APP will access data from the machine/robot at the time of entry. This data will include specific information such as fault logs and production data and will automatically capture video footage. This information together with the inputted data from the plant maintenance will ensure MAR service and/or project teams receive the required information to address current issue or request promptly.
The functionality of this APP requires actual machine/robot data to be accessed. This increases the complexity of the APP design and functions over relatively simpler data entry APPS. APP development will require software patches to be written for any machine this APP is to access and use of the APP will require a machine/robot system to have MAR-REMOTE-RM support package fitted.
RM Service Tool APP for iPad will allow access to multiple machines/robots where access is available and where the APP is setup to do so.
Processors have expressed interest in this development because it provides MAR the ability to quickly assess machine/robot troubles without the requirement of maintenance staff to assist or even to be on-site when the request is activated.

4.2.3 Red Meat HMI APP

This APP is directly focussed on capability building and post-sales support for technology installed within the industry and will be designed to support MAR technologies. The functionality will assist adoption and commercialisation of technology by offering improved support mechanisms.

The Red Meat HMI APP for iPad will provide a remote Human Machine Interface (HMI) or SCADA type interface to view machine robot and PLC status allowing iPad operator to view critical production and machine maintenance data. Typically this functionality is only available using expensive dedicated HMI interfaces built into the machine cell or using a factory SCADA system.

The functionality of this APP requires actual machine/robot data to be accessed. This increases the complexity of the APP design and functions over relatively simpler data entry APPS. APP development will require software patches to be written for any machine this APP is to access and use of the APP will require a machine/robot system to have MAR-REMOTE-RM support package fitted. Significant machine data access and data manipulation will be required for this APP and the information required will differ from machine to machine. Actual APP development will incur a number of screen designs and configurations to be setup all of which offers challenges for communications and data transfer.
RM HMI APP for iPad will allow access to multiple machines/robots where access is available and where the APS is setup to do so.
Processors who have expressed interest in this development have an interest in the ability to view real time production data, graphs and trends. This provides an excellent production management tool and allows maintenance and engineering staff to access critical real time data.

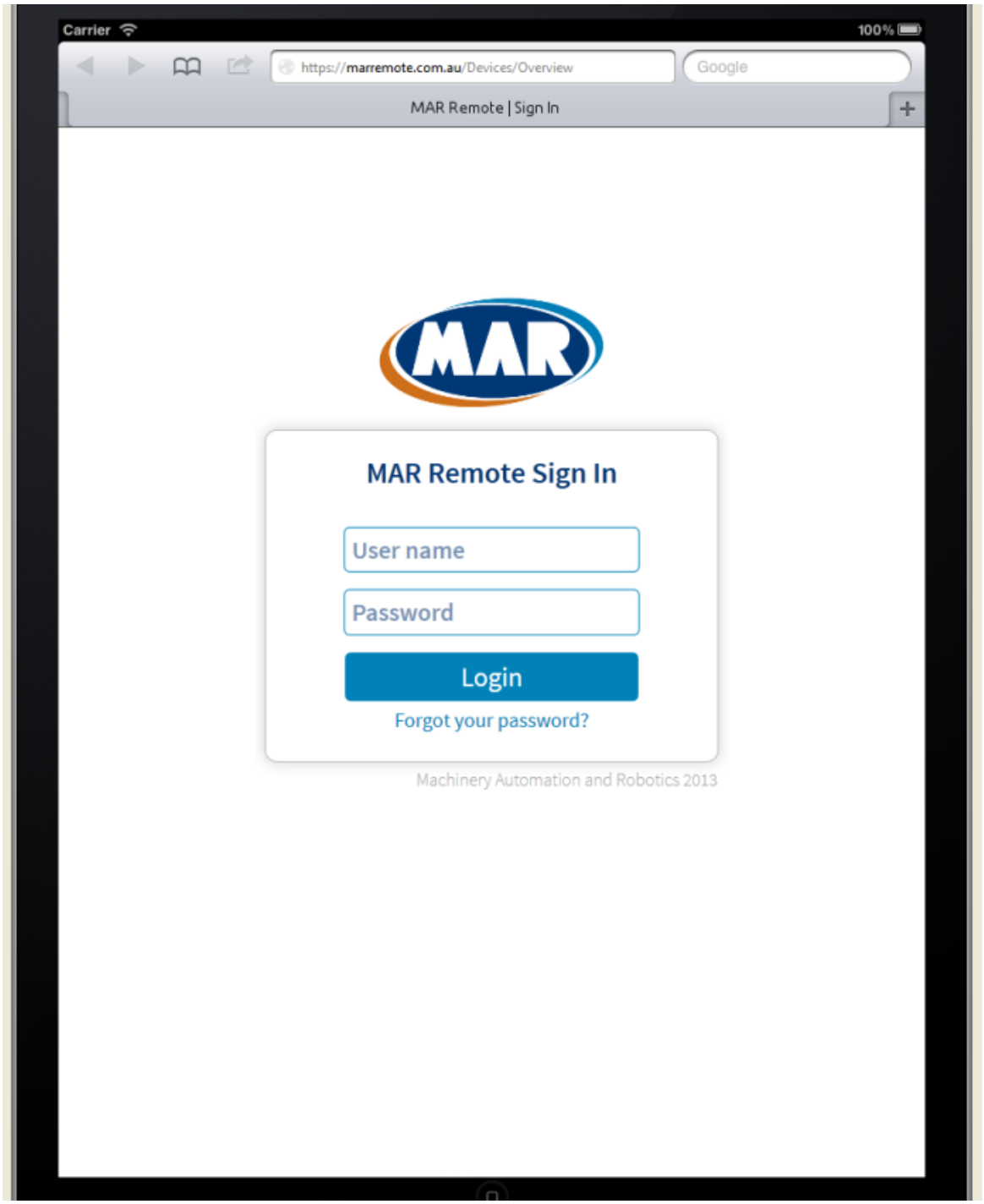
4.2.4 iPad APP Software development

The software for the 3 APP's is written using C#, using the .NET framework version 4.0. The site is hosted as an ASP.NET MVC3 application and can be accessed via HTTP .
The ASP.NET MVC site uses a Microsoft SQL Server database to store client and contact details, as well as connectivity details to reach the customers site. At each customer site, a Microsoft .NET WCF Service (using TCP) is hosted on a PC. The APS.NET MVC site connects to this service and from there retrieves details including robot details, and a set of live video streams. The live video streams are retrieved securely and then streamed to the end customer via their web browser. This supports PCs as well as iOS and Android mobile operating systems.

Access to the site is secured by a username and password for each contact at a customer site. The site itself is hosted centrally at MAR and available via standard internet access.

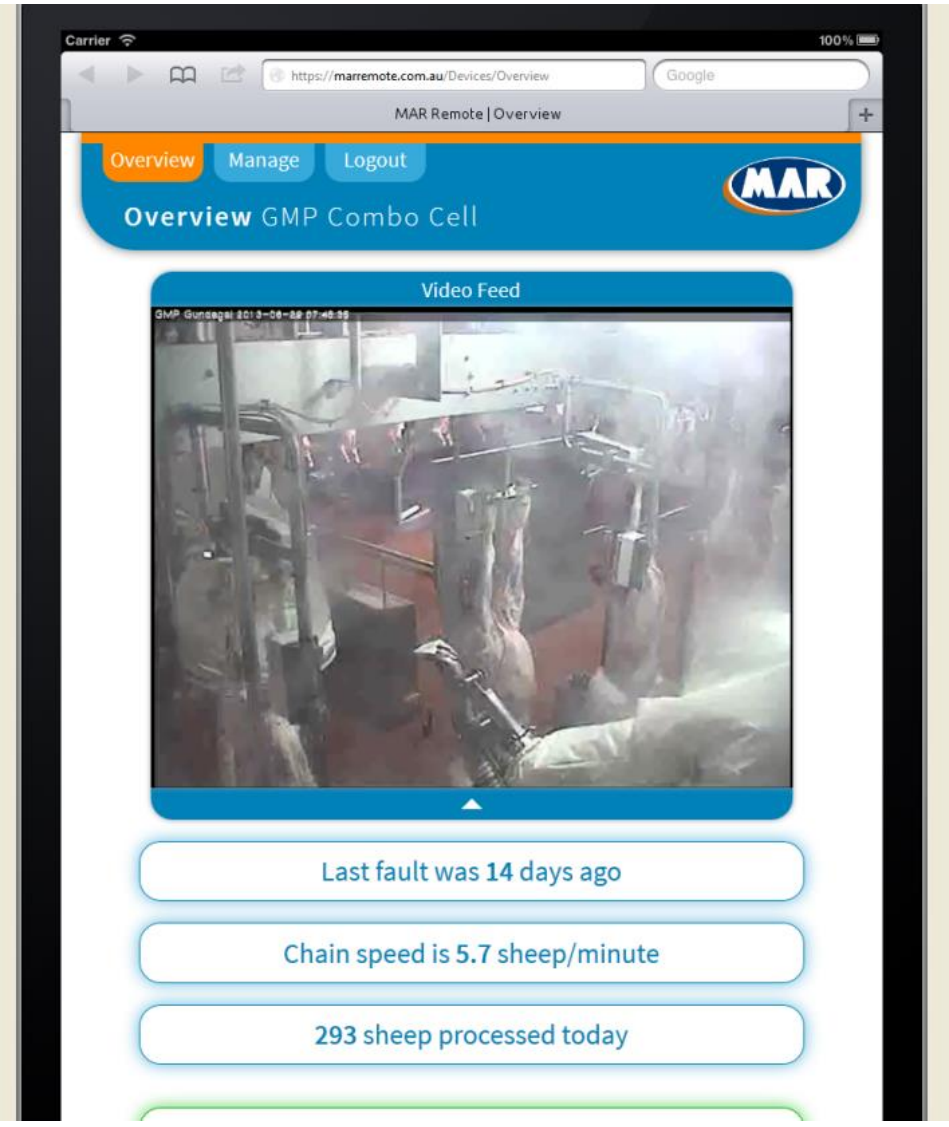
4.3 Red Meat Remote APP

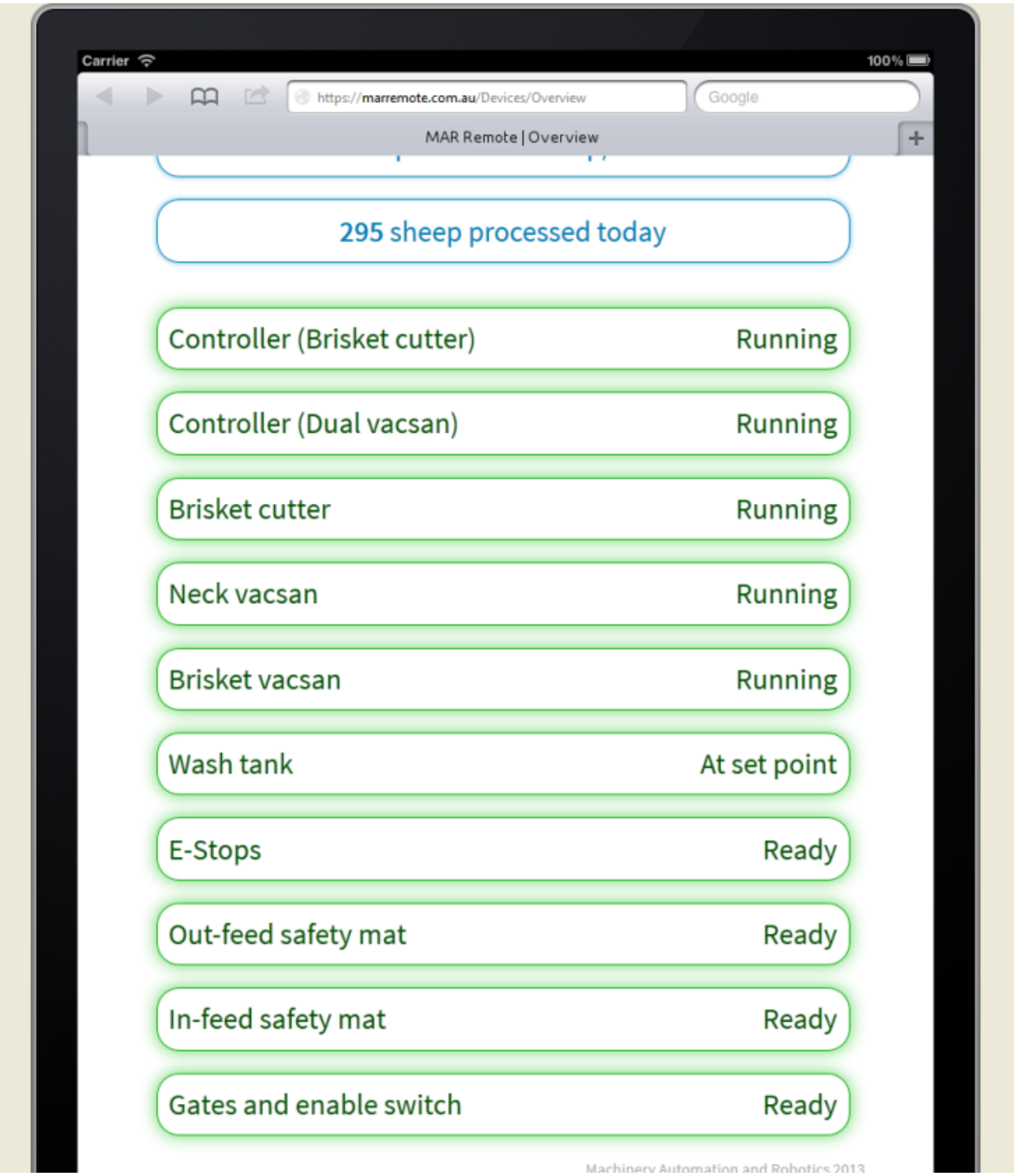
The image below shows the start up screen for the Red Meat Remote APP, each processor will have a unique User name and Password.



After logging in the screen below is shown. This screen shows the video being streamed from Gundagai Meat Processors along with live production data. The following screen shows the status of the items within the Robot Cell:

- The status of Brisket Cutter and Sani Vac Controllers
- The status of the individual Sani Vacs and Brisket Cutter
- The status of the Wash Tank
- The status of the cells Estops
- The status of the gates and enable switch
- The status of the safety mats.




Carrier
100%
https://marremote.com.au/Devices/Overview
Google
MAR Remote | Overview
295 sheep processed today
Controller (Brisket cutter) Running
Controller (Dual vacsan) Running
Brisket cutter Running
Neck vacsan Running
Brisket vacsan Running
Wash tank At set point
E-Stops Ready
Out-feed safety mat Ready
In-feed safety mat Ready
Gates and enable switch Ready
Machinery Automation and Robotics 2013

This APP was installed on site at GMP during July 2013. Site Feedback was obtained following the iPad and APP being on site for a month. The following comments came from Peter McDonald Maintenance Manager:

'It's good but obviously only basic at the moment, not sure how we will use it at GMP yet'

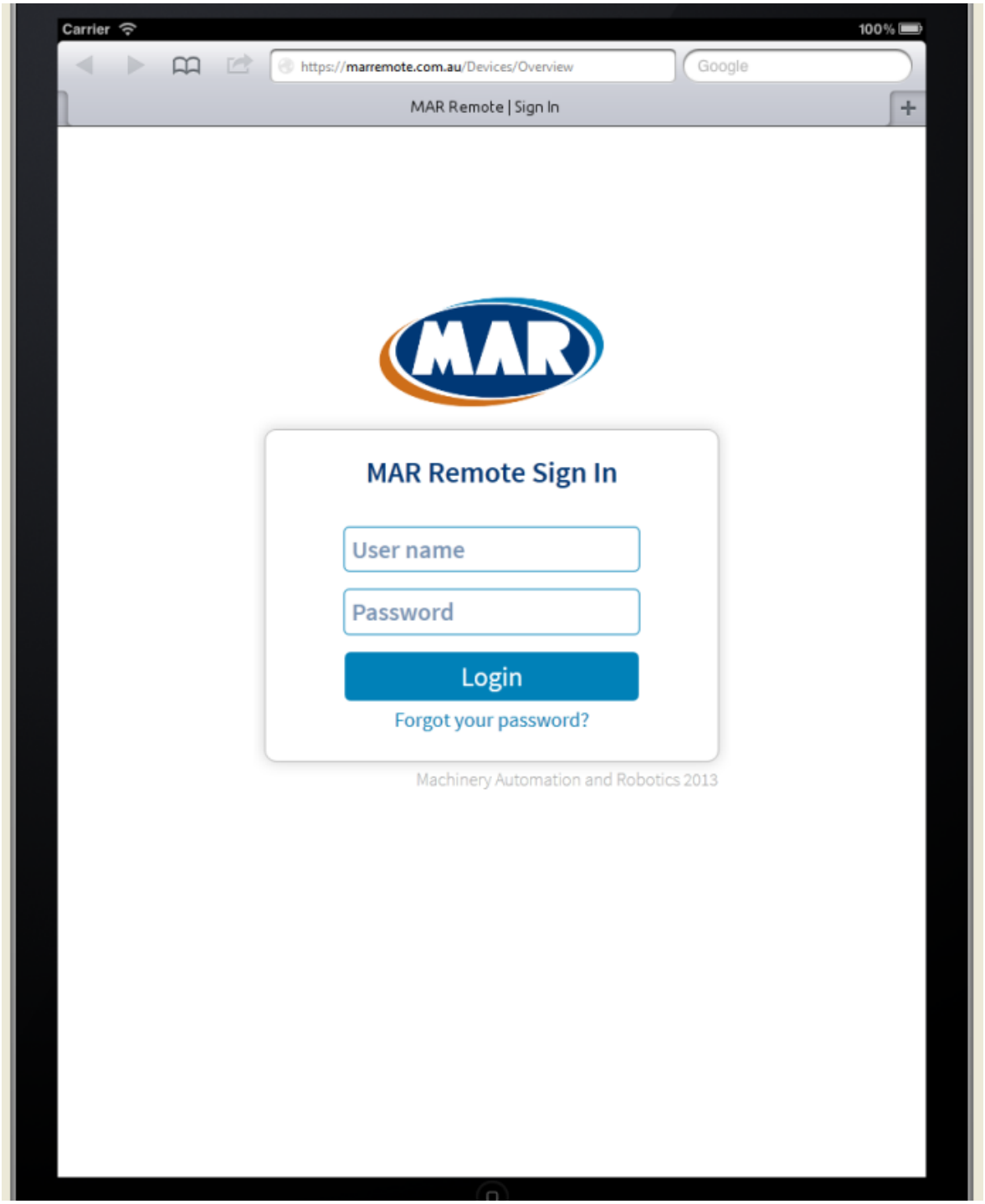
'Had another look this morning, it's good but very basic, I may get a little more excited when the faults with descriptions are on it'

In discussions with Peter and as was discussed with MLA at the time it is felt that this APP would be suitable for upper management to display robots in action on their site but not that useful from a maintenance point of view. Peter expressed desire for the APPs to include a fault message pop up and history. Such that in the event of a fault the iPad could be used to identify the fault and from this the correct person onsite could be contacted to resolve the issue as quickly as possible.
Internal discussions at MAR indicate that fault message/ history indication is certainly possible and that it would be suitable for implementation into APP 3, Red Meat HMI APP.

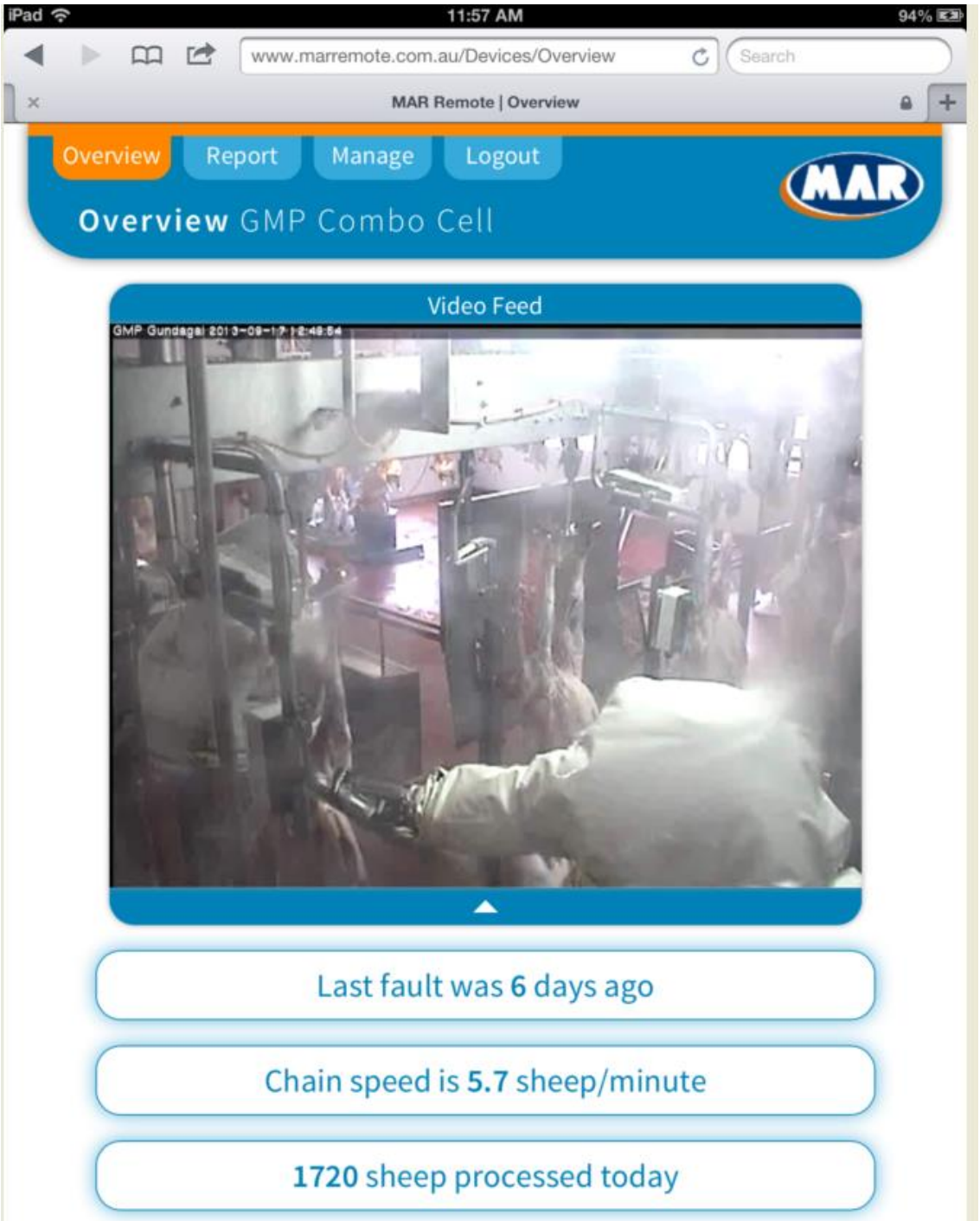
Further discussions have been held with MLA since this feedback and it is agreed that '…the iPad APP shows great potential to offer an additional feature/benefit which may support adoption of MAR's automation solutions, and to demonstrate to the industry another application of leading edge technology to support world class food production'.

4.4 Red Meat Service Tool APP

As with the first APP the user logs in using their unique User Name and Password. This will allow them access to the APP's that are relevant to their site.



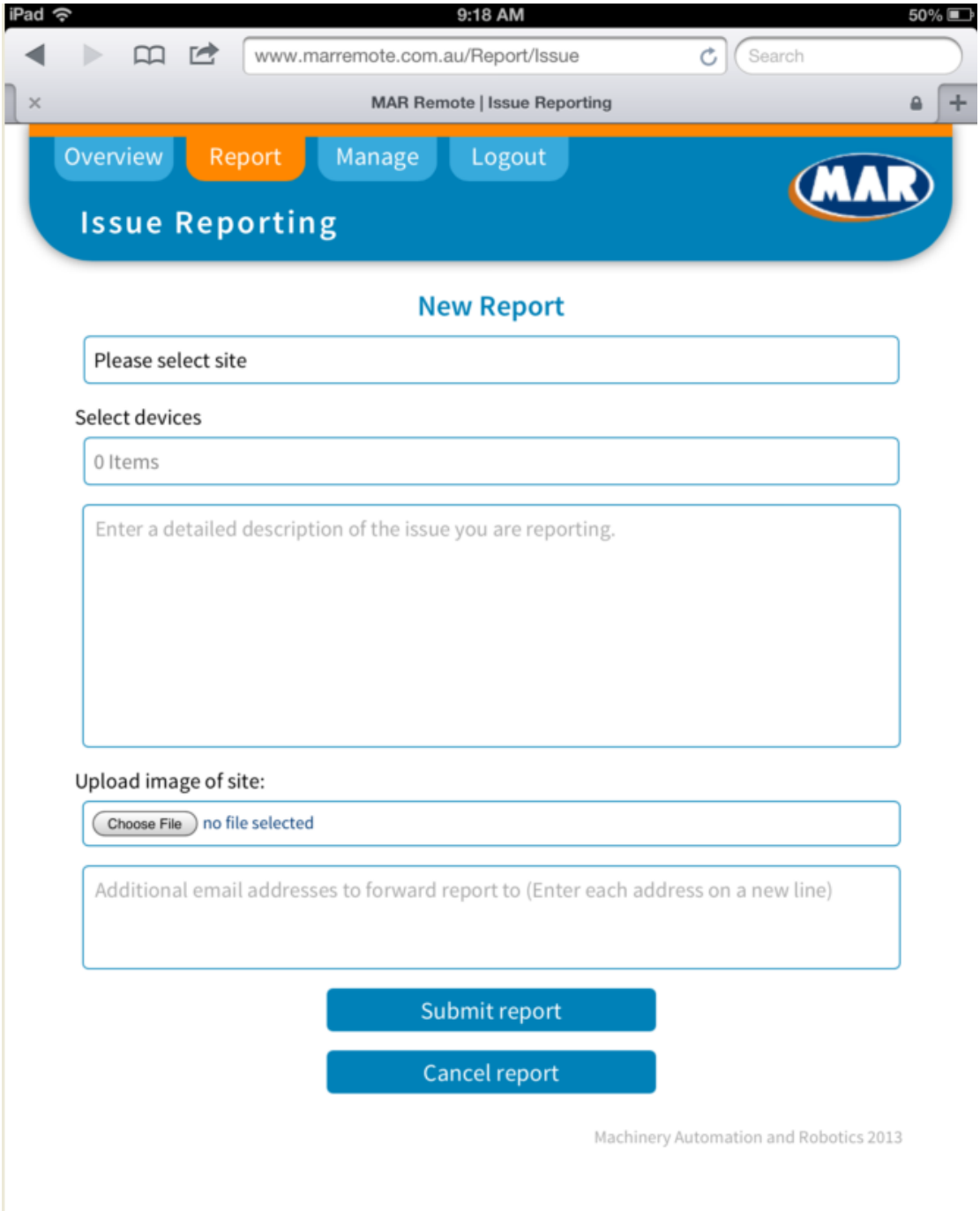
Once logged in the Overview Screen appears now with the additional ‘Report’ tab available for selection



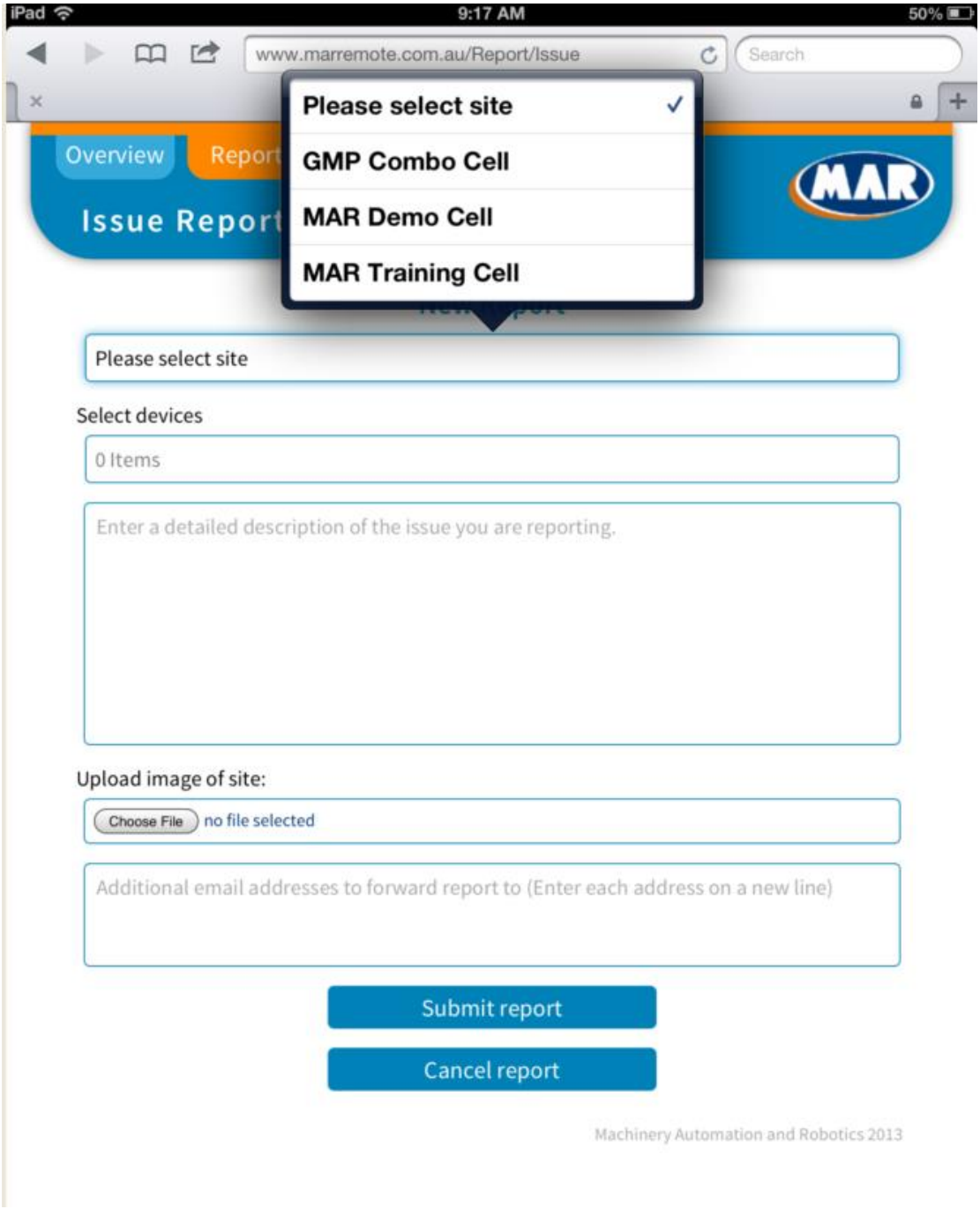
When the 'Report' tab is selected the following screen is displayed. This is a list of the reports that have previously been submitted and the status of each, who actioned the report and when it was actioned.

Pressing on any of the reports displays the details of what was reported including log files, images and videos.

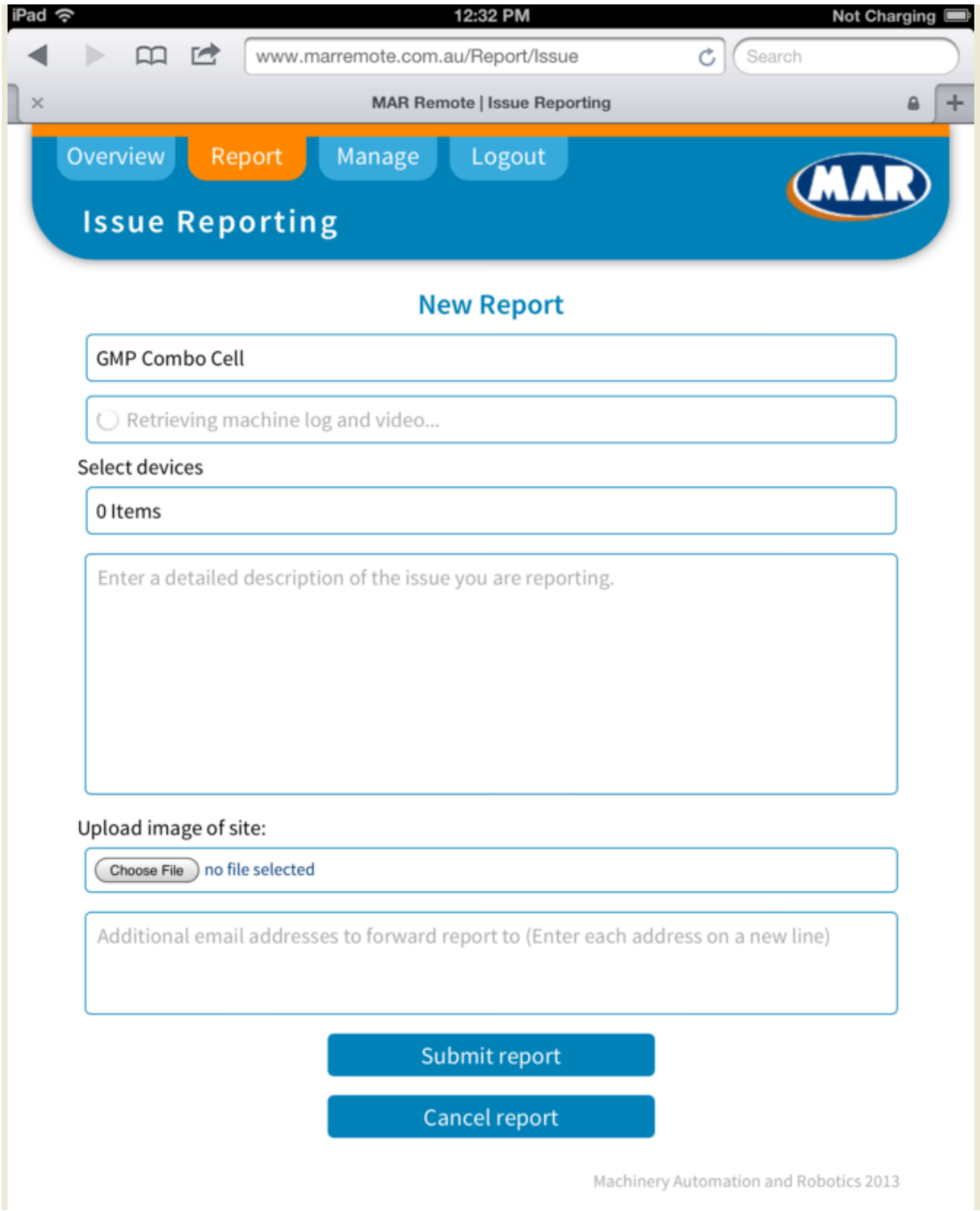
To create a new report, the user clicks '*Begin new report'*. This displays the reporting form shown below:



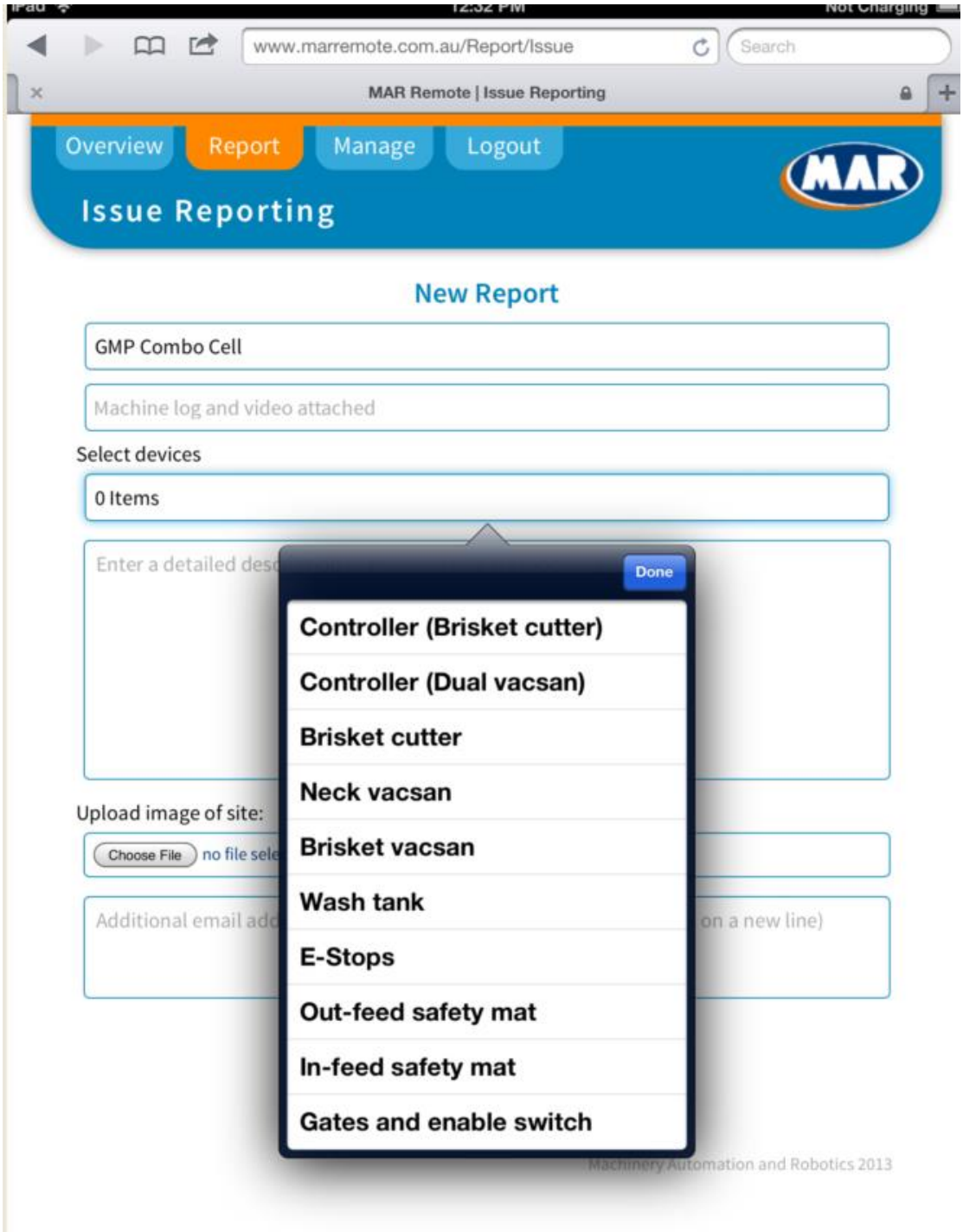
By tapping the ‘Please Select Site’ area the user selects the site/system that the report is for. There may be one or more selections available here depending on how many systems are set up on site. The user will only have access to systems relevant to their particular site.



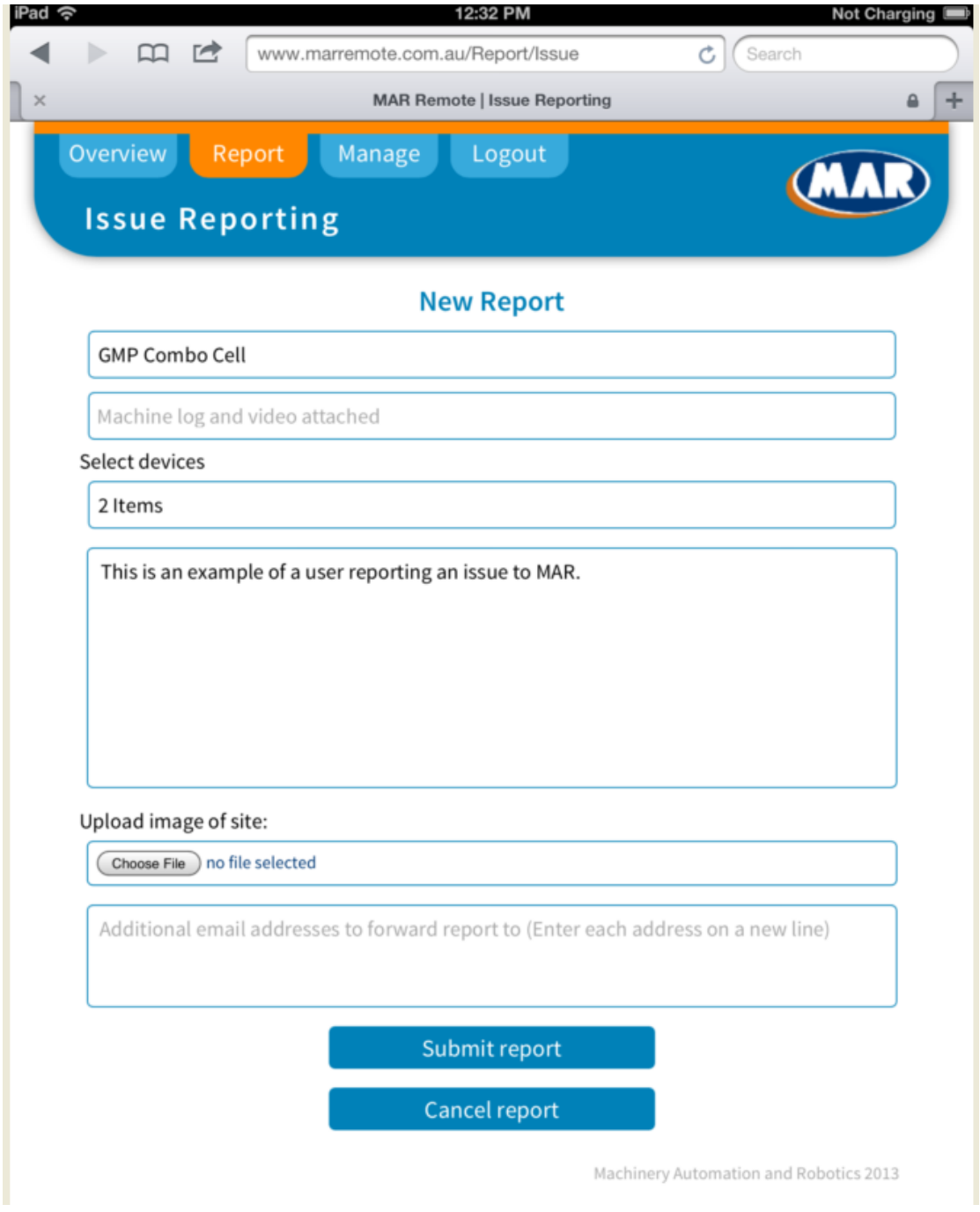
Once the site/system is selected the APP begins to download the fault log and video files, this is shown in the screen below:



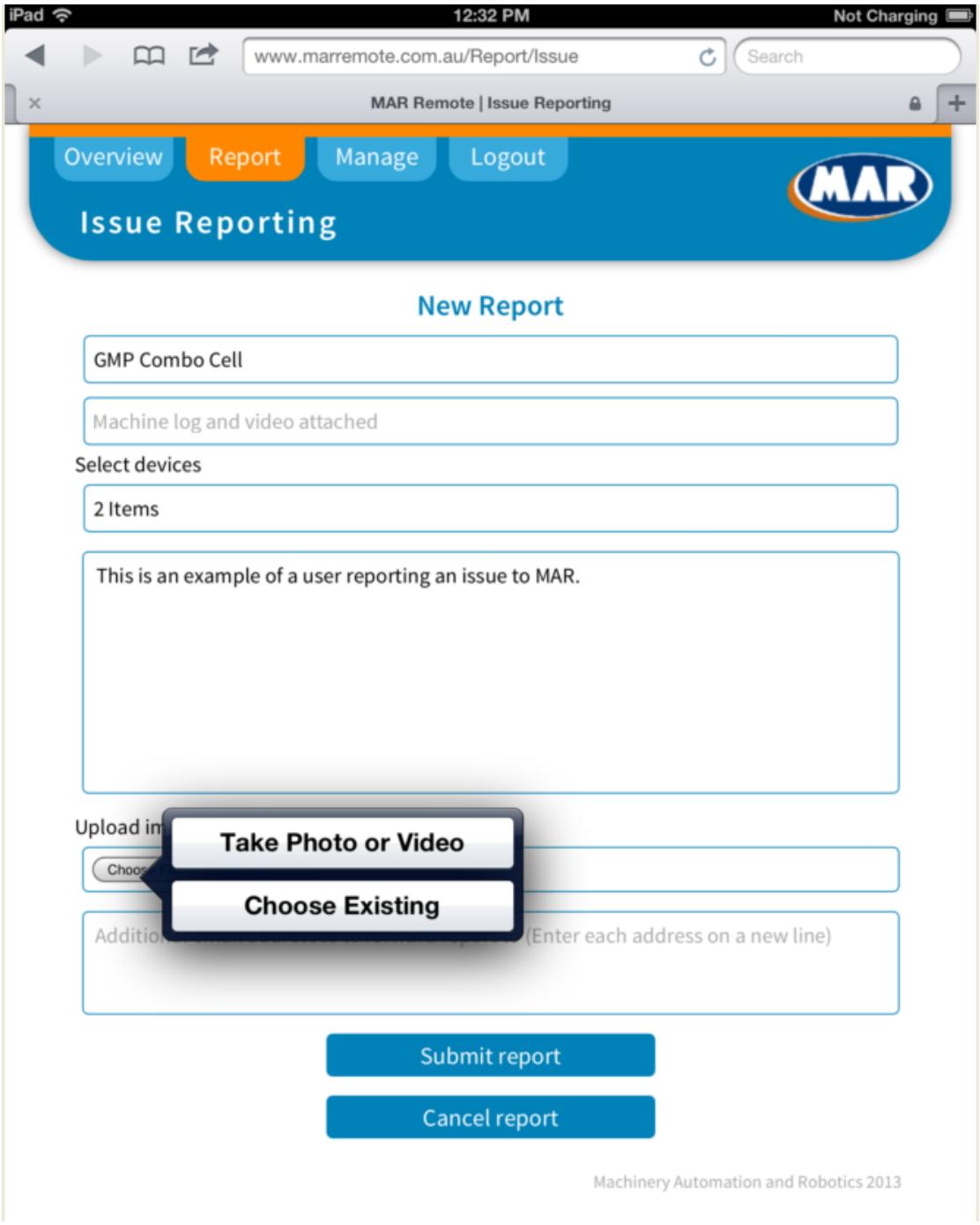
The user then selects all the devices at the site that the report concerns. Note the message now that the relevant log file and videos are attached.



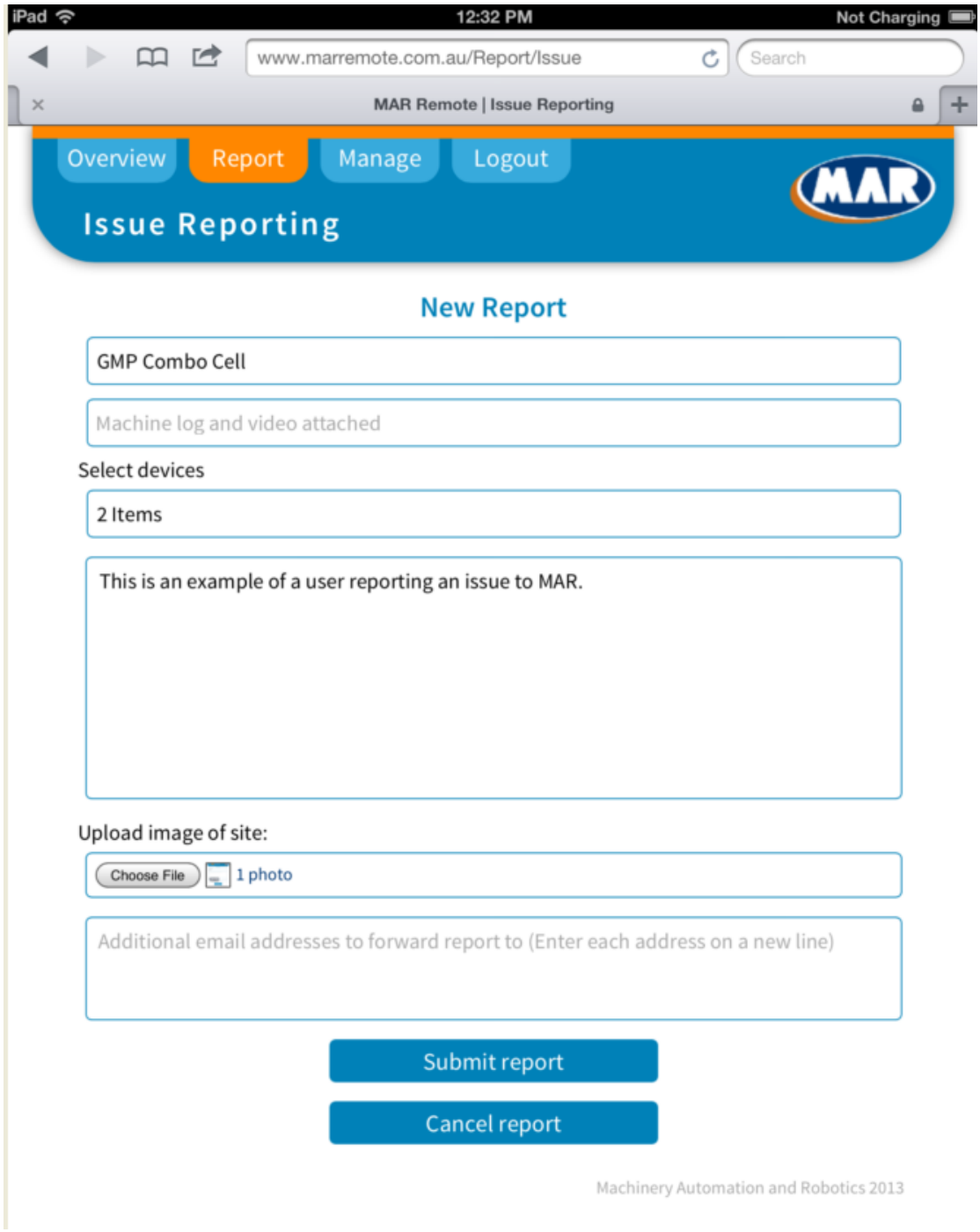
A detailed description of the issue is then entered



The user has the option of uploading a photo or video of the issue directly from the iPad

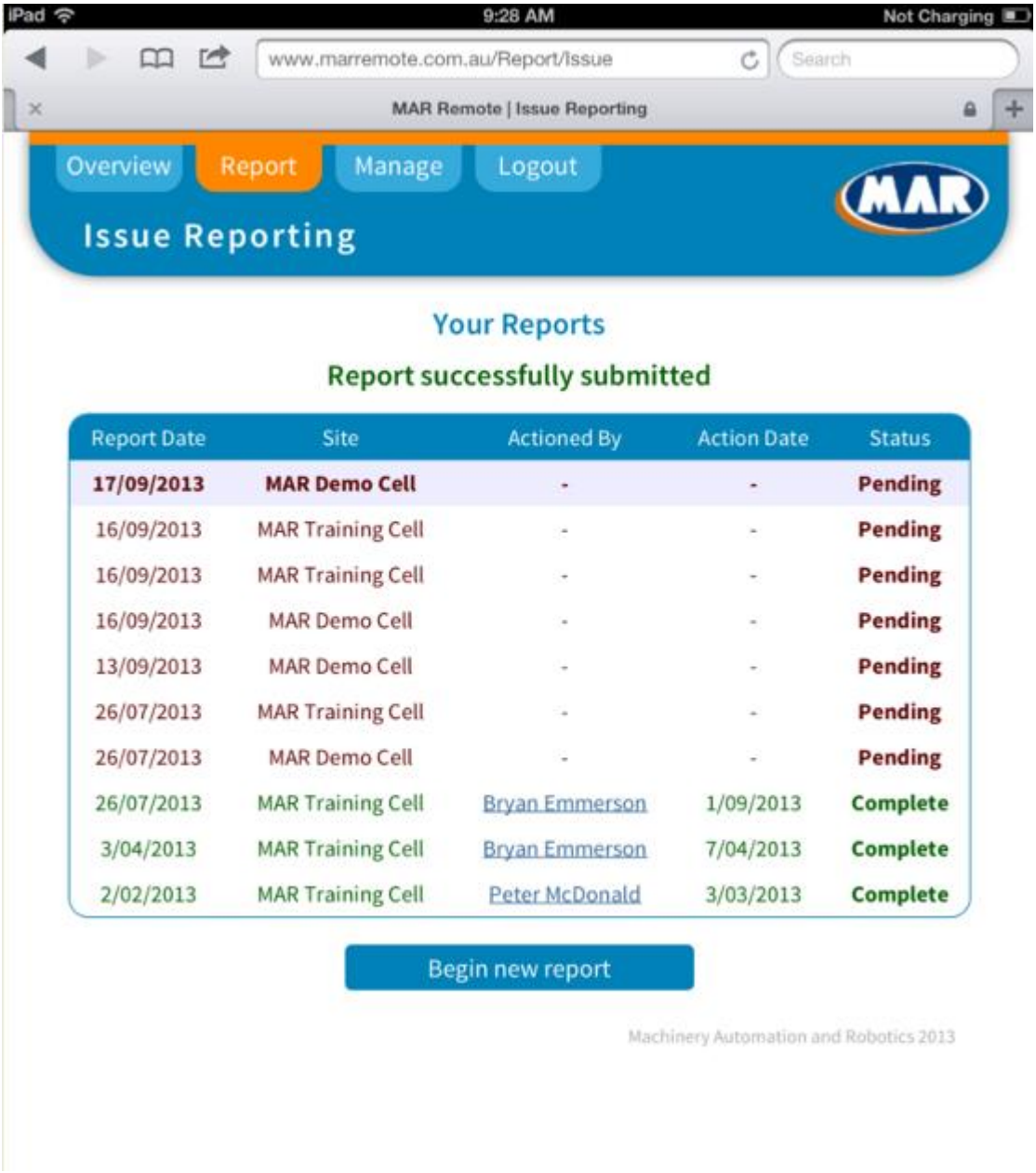


Once selected, the picture/video appears in the upload box

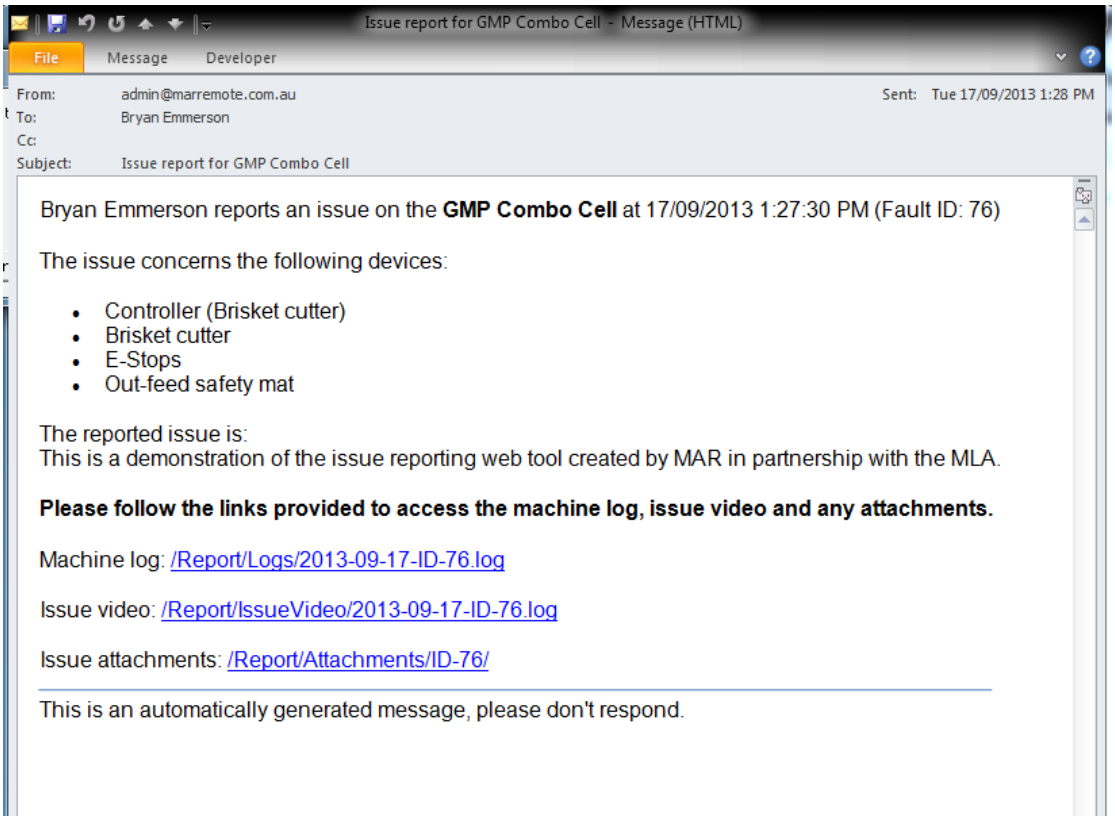


When the report is sent the email, by default, goes to a general MAR service email address that is received by our service department. A copy is also sent to the nominated site contact so that they can be sure the email has been dispatched. Additional email addresses may be entered in the box at the bottom of the report to allow the report to be sent multiple of addresses.

Once this is complete the user taps the ‘Submit Report’ button at the bottom of the screen and the email containing all the information is sent to the required people. Once the user submits the report, the newly-submitted report is highlighted in the list.



The email received by the people in the list takes the following format. The recipient can then tap the links to be taken to the relevant images, video and log files.



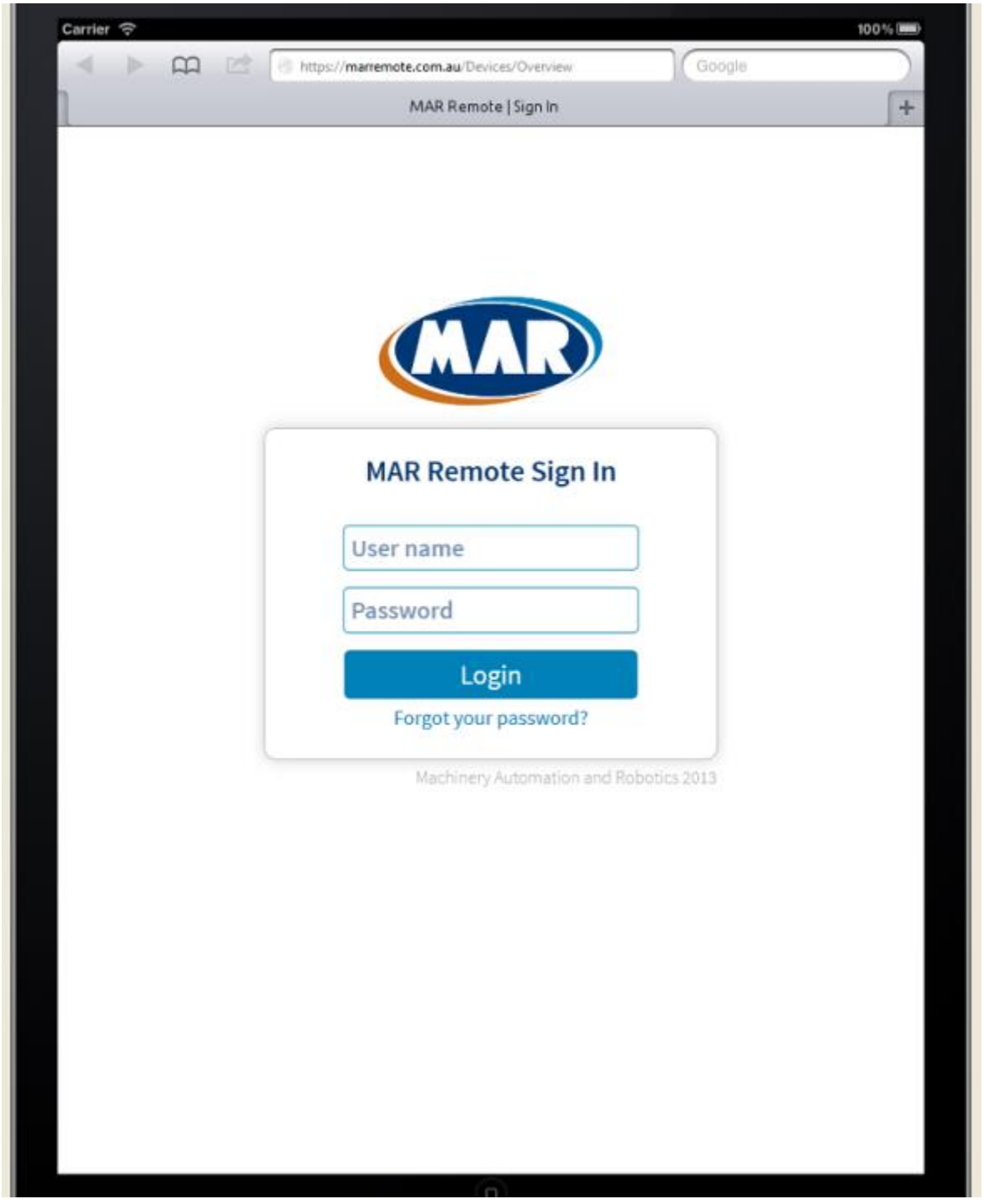
Following a month of this APP being installed on site, feedback was sort from Peter McDonald, GMP Maintenance Manager, his response was as follows:

'….. this is good, I can see this being useful, especially now that we are having WiFi installed throughout the plant….. we will be able to have the iPad at the cell and send the email directly from there'.

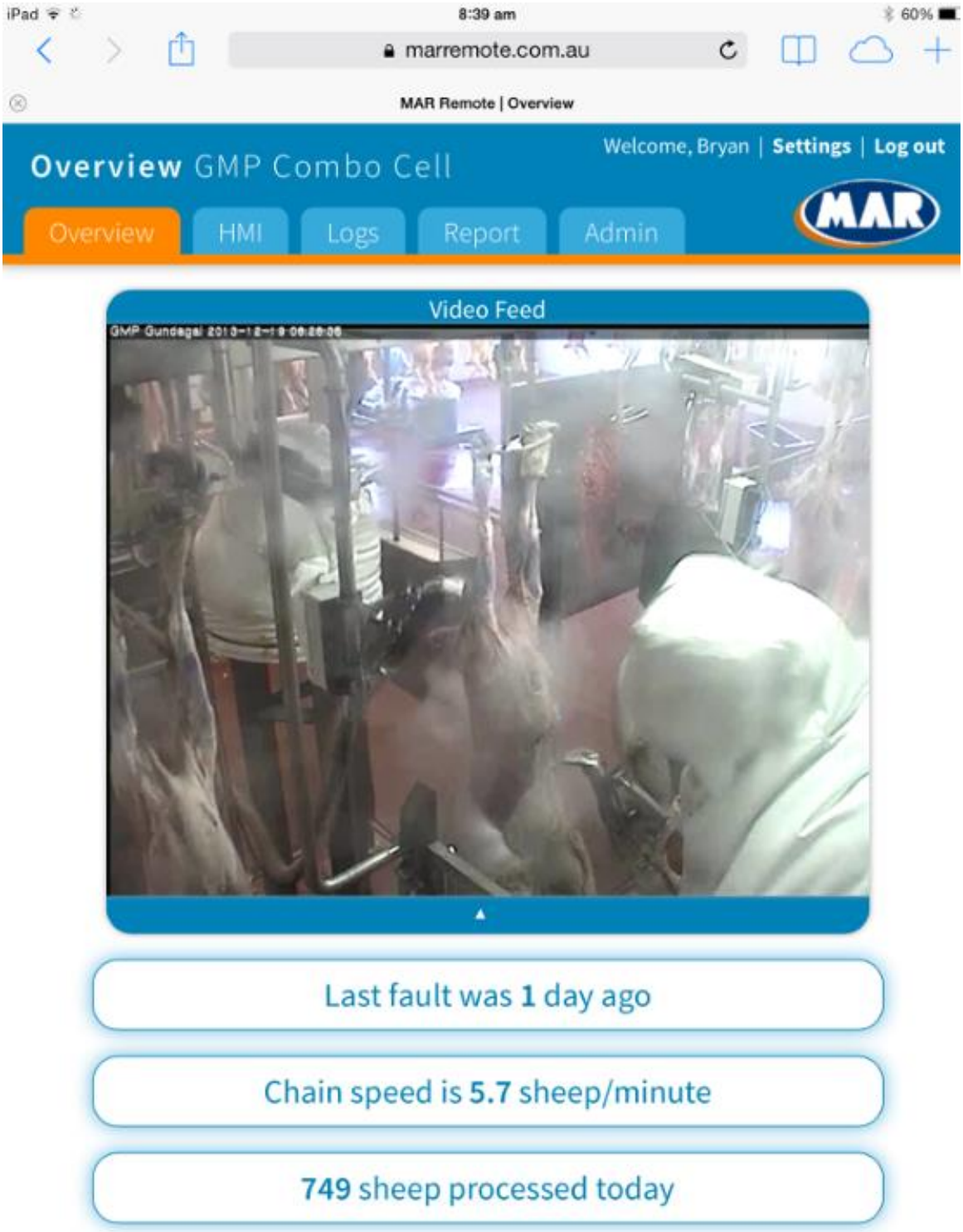
An example of this APP in use has been when there were discussions between MAR and GMP with regards to issues being experienced with the robot bags. Peter was able to video with the iPad the robots operating and send the video for discussion to MAR.

4.5 Red Meat HMI APP

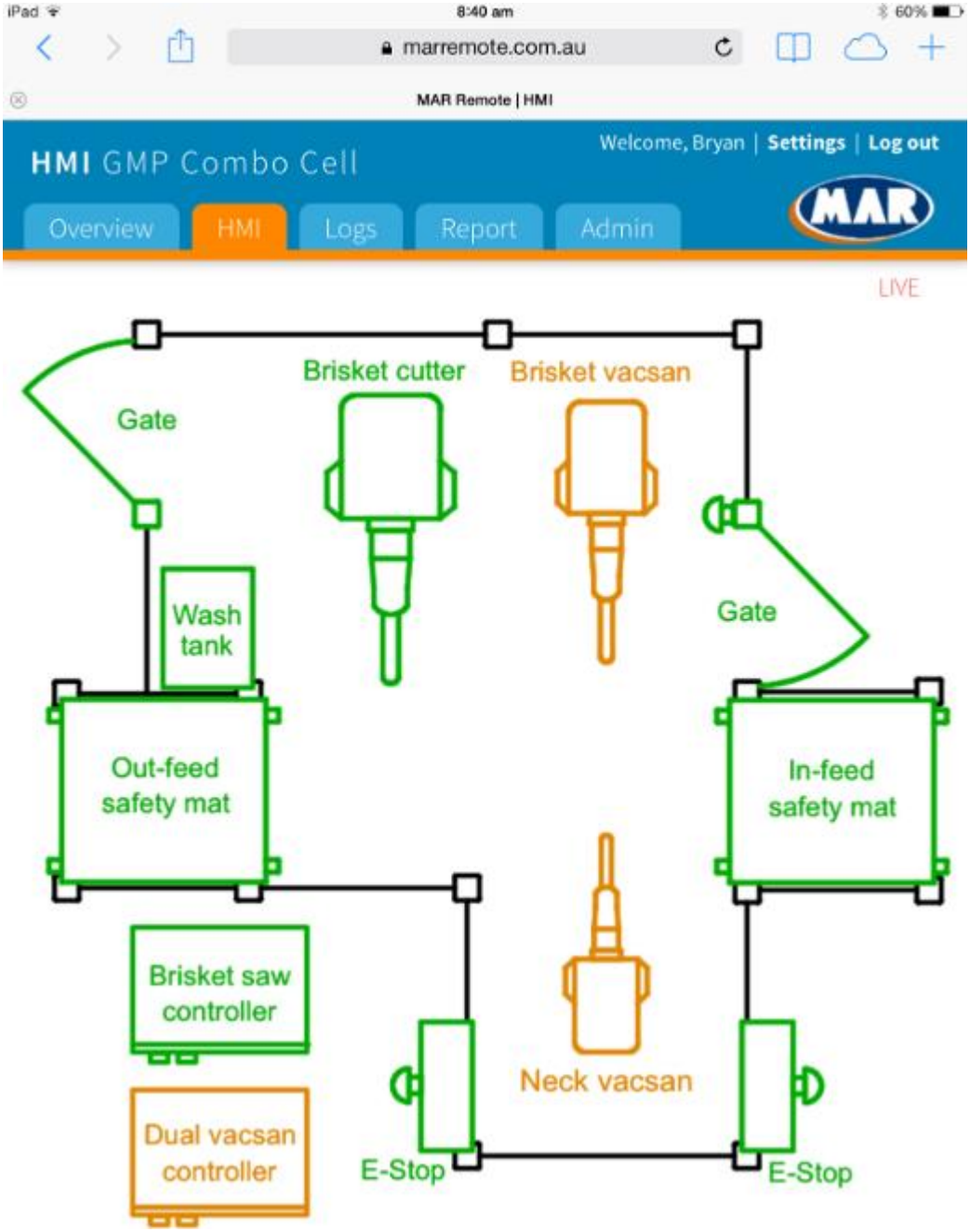
As with the first two APP's the user logs in using their unique User Name and Password. This will allow them access to the APP's that re relevant to their site.



Once logged in the Overview Screen appears now with the additional ‘HMI’ and ‘Logs’ tab available for selection



When the ‘HMI’ tab is selected the following screen is displayed. This screen shows the cell at Gundagai.

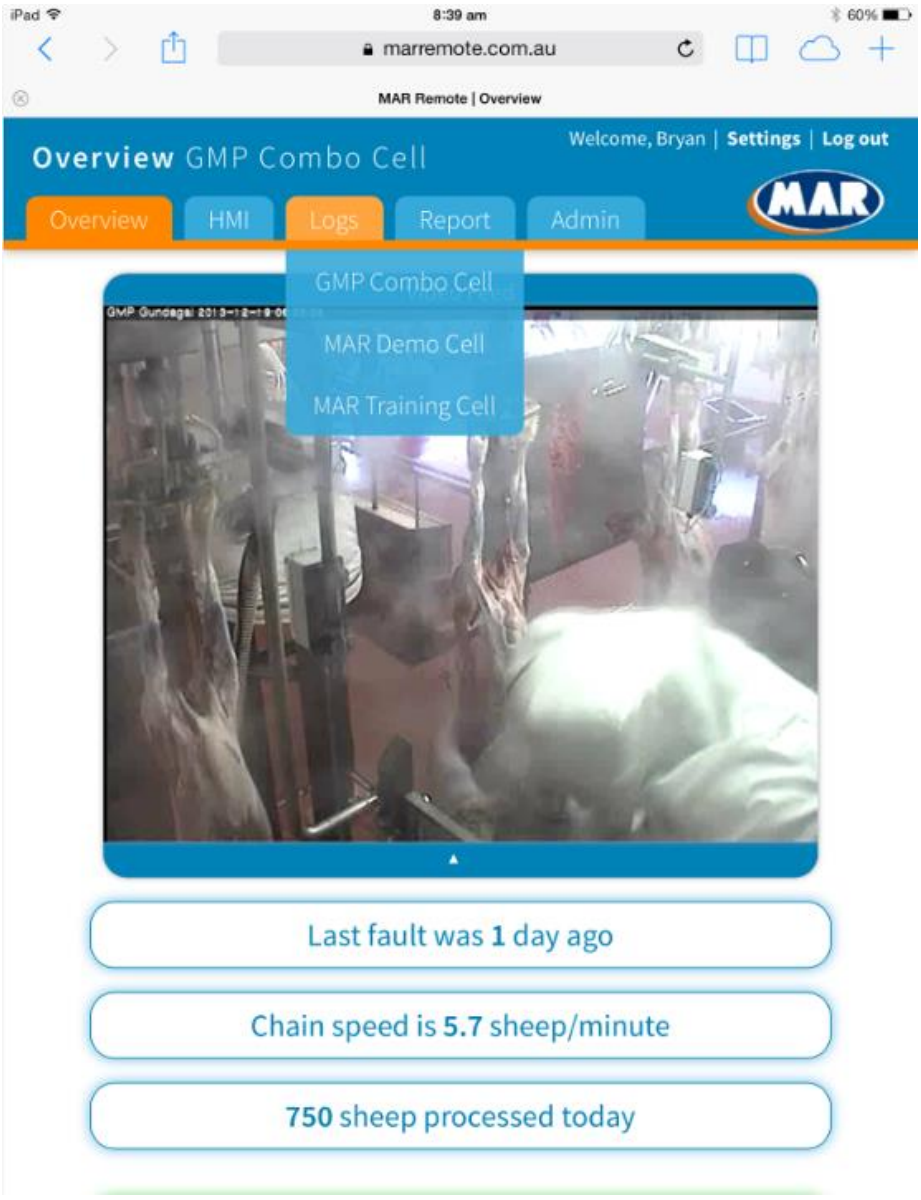


Each component of the cell is depicted in the image and changes colour depending on its status:

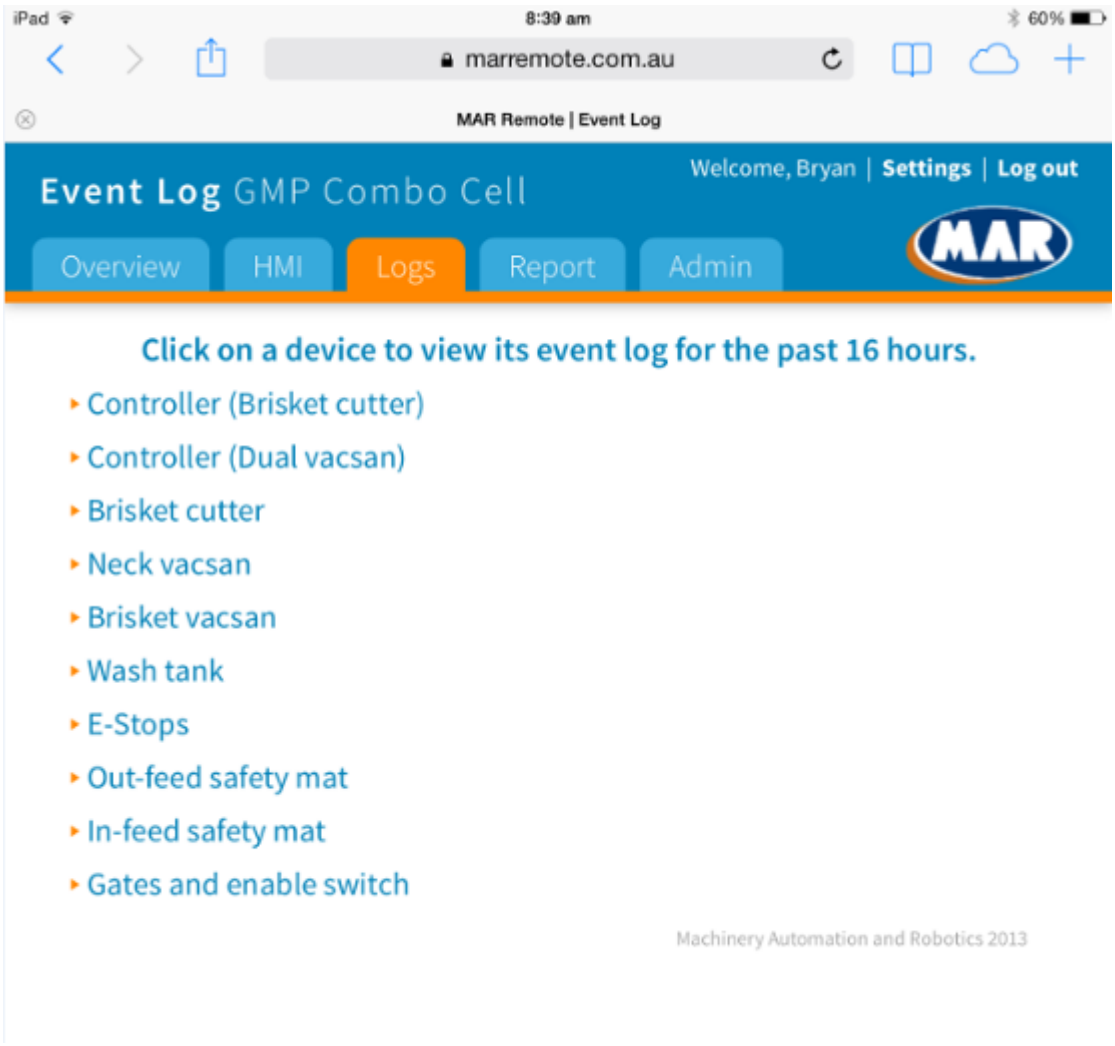
- Green – Item OK no faults or warnings
- Amber – Item has a warning
- Grey – Item is offline

- Pale Red – Safety trip
- Dark Red - Fault

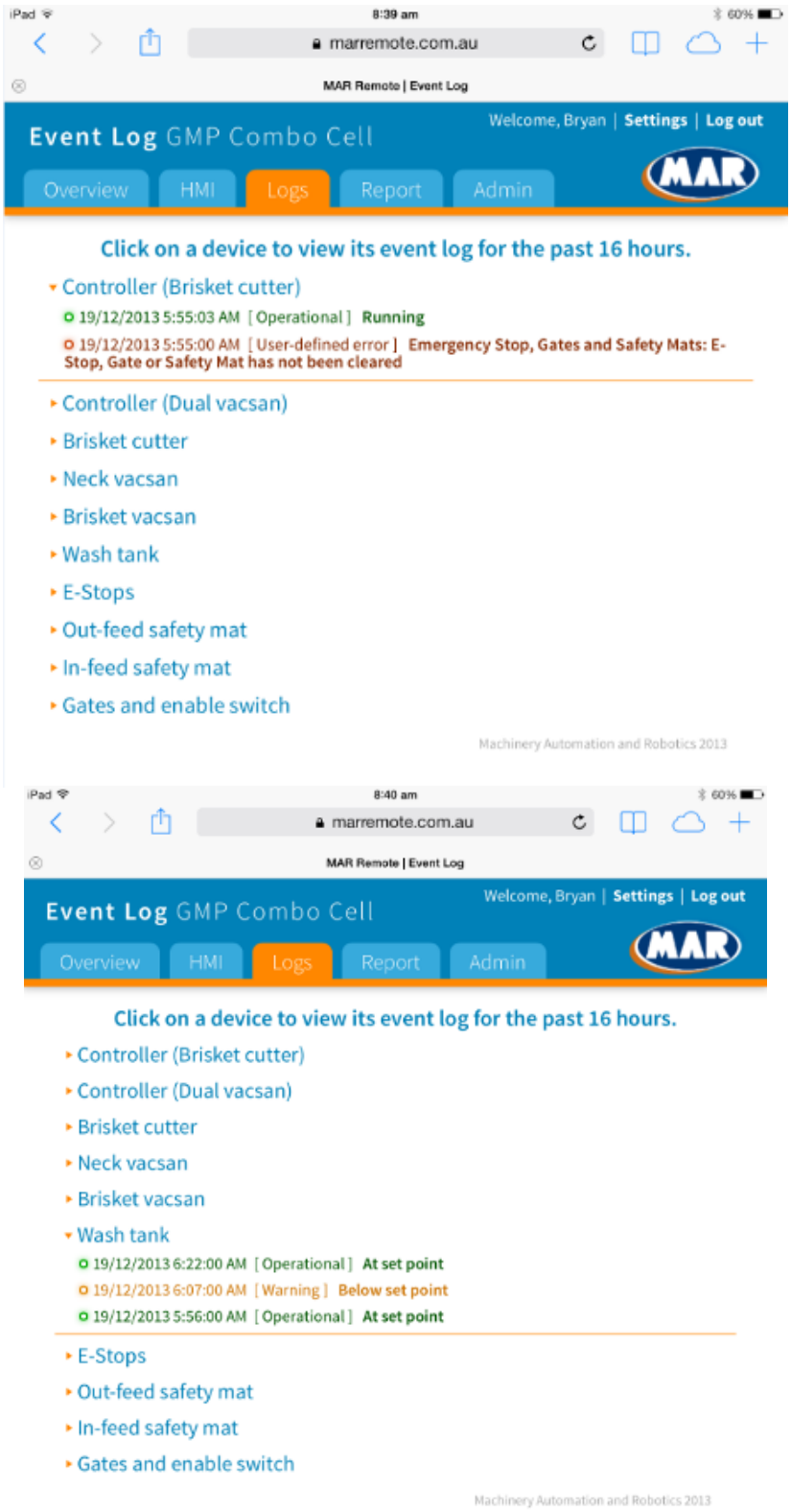
This gives maintenance/management a quick and easy way of seeing whether the robot cell is healthy and operating correctly. If faults or warnings are noted on this 'HMI' screen the iPad operator can select the 'Logs' tab to investigate the issues further. The image below shows this:



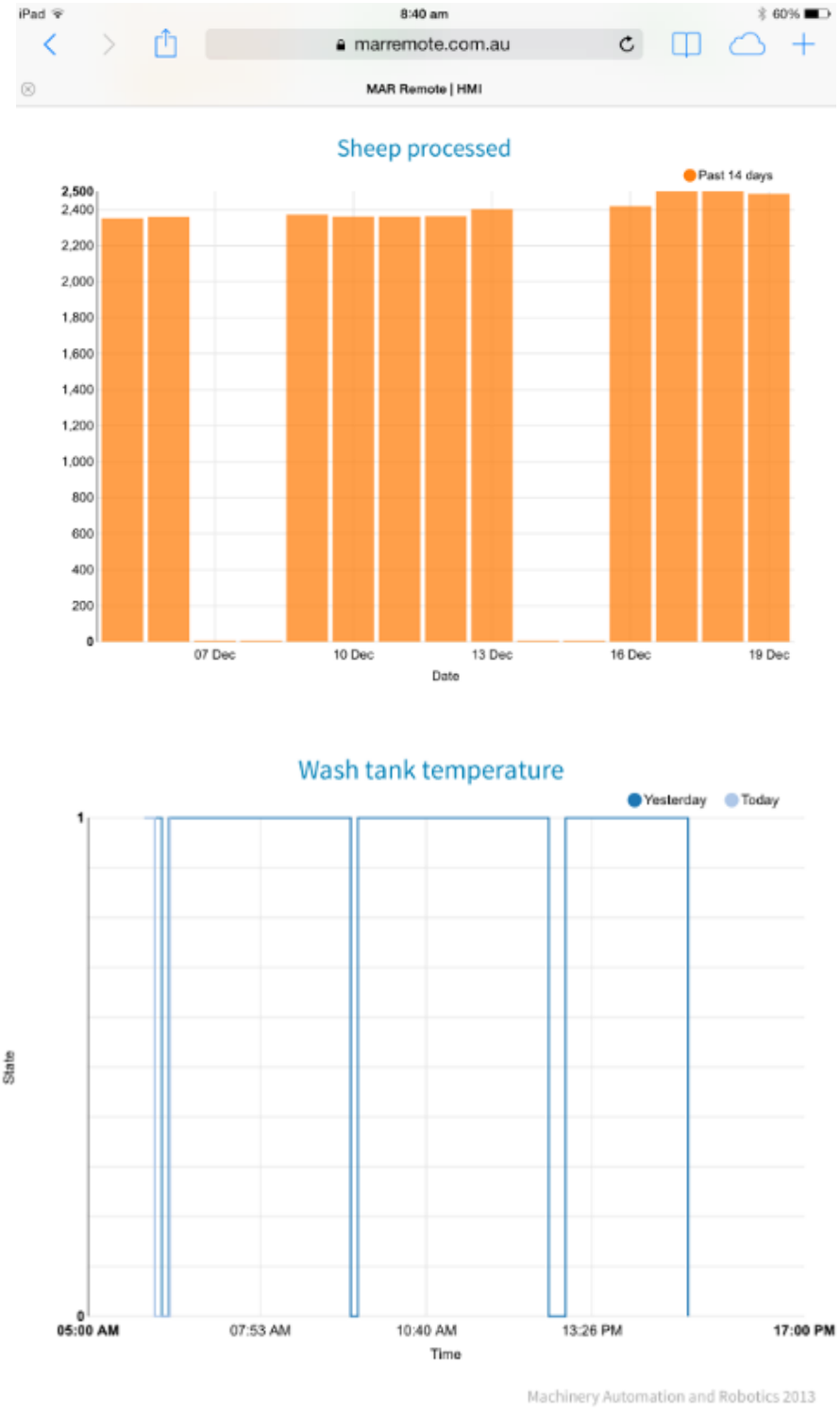
By pressing the GMP Combo cell (onsite GMP will only have access to this option) the following screen appears.



The iPad operator then selects the component they wish to investigate further, in the screens below the Brisket cutter controller and Wash Tank are selected respectively. In this way they can identify the issue and send the correct maintenance personnel to attend to the issue.


iPad
8:39 am
60%
marremote.com.au
MAR Remote | Event Log
Event Log GMP Combo Cell
Welcome, Bryan | Settings | Log out
Overview
HMI
Logs
Report
Admin
MAR
Click on a device to view its event log for the past 16 hours.
Controller (Brisket cutter)
19/12/2013 5:55:03 AM [Operational] Running
19/12/2013 5:55:00 AM [User-defined error] Emergency Stop, Gates and Safety Mats: E-Stop, Gate or Safety Mat has not been cleared
Controller (Dual vacsan)
Brisket cutter
Neck vacsan
Brisket vacsan
Wash tank
E-Stops
Out-feed safety mat
In-feed safety mat
Gates and enable switch
Machinery Automation and Robotics 2013
iPad
8:40 am
60%
marremote.com.au
MAR Remote | Event Log
Event Log GMP Combo Cell
Welcome, Bryan | Settings | Log out
Overview
HMI
Logs
Report
Admin
MAR
Click on a device to view its event log for the past 16 hours.
Controller (Brisket cutter)
Controller (Dual vacsan)
Brisket cutter
Neck vacsan
Brisket vacsan
Wash tank
19/12/2013 6:22:00 AM [Operational] At set point
19/12/2013 6:07:00 AM [Warning] Below set point
19/12/2013 5:56:00 AM [Operational] At set point
E-Stops
Out-feed safety mat
In-feed safety mat
Gates and enable switch
Machinery Automation and Robotics 2013

In addition to the view of the cell on the ‘HMI tab’, by scrolling down the trends shown in the image below are displayed. This gives the iPad operator an historical summary of sheep processed and wash tank temperature.



This APP has been used onsite by GMP maintenance staff over the past 2 months and has assisted them in diagnosing issues that have occurred on the combo cell.

5 Success in Achieving Objectives

This project has, over the past 6 months, progressively installed the three iPad APP's at Gundagai meat processors. Work on the initial ROC Excel tool demonstrated that the idea of having a method of gathering data was useful but that more benefit would be gained by having such a form installed as an APP on an iPad to allow direct entry.

The Red Meat Remote APP achieved its objectives of providing a remote interface to view a web cam mounted on site as well as simple production status information allowing the iPad operator to view critical production data and machine operations. It was felt that this APP is suitable for Management to be able to remotely view robots in operation and confirm the system is operating.

The Red Meat Service Tool APP has successfully provided an easy and quick way of providing feedback to MAR on issues being experienced with the robots and this was demonstrated by the use of this APP in describing a robot bag issue on site at GMP.

The Red Meat HMI APP is providing ongoing support to the maintenance staff at GMP allowing them to easily and quickly identify any issues that arise on the Robot Cell

6 Conclusions and Recommendations

With the positive feedback with regards to the iPad APP received from GMP and also at the recent Red Meat Technology Update Day held at MAR, MAR plans for further Roll Out and development of iPad APPs in the Red Meat Industry, targeting processors with MAR Robot installation initially.