Final Report

AMPC
AUSTRALIAN MEAT PROCESSOR CORPORATION

# IoT Solutions

## IoT Automated Temperature Monitoring


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Prepared by
Lincoln Waldock & Peter Reeve
(Constellation Technologies)

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# 1.0 Executive Summary

To achieve JBB's vision, JBB are undergoing an entire company wide innovation program to debottleneck the process (from livestock receivals to cartons leaving the facility), reduce waste leaving the site (including being more resource/services efficient), and to change the nature of the work to both reduce the per head/hour labour requirement (as a KPI) and ensure that those resulting jobs are designed in a way to be open to both a wider physical stature workforce and hours of operations that suit varying employment demographics within the labour draw pool.

# 2.0 Introduction

This project was developed to understand the suitability of IoT solutions to enhance operations and reduce costs through near real-time automated ambient temperature monitoring of critical control points, providing the ability to visualise and monitor room temperatures via a web browser and mobile application, as well as, provide alerts and alarms in the event of a temperature breach. The IP rated enclosure unit supplied to form part of this solution included an IP67 M8 socket to facilitate connection with an external stainless steel insertable meat probe, used to monitor muscle cool down over a defined time period for quality control purposes. The IoT platform provides the ability to visualise live and historical data, provide automated HACCP and refrigeration index reports, and continuous storage of temperature data over the period of the subscription.

The solution also offers the ability to digitise paper processes, such as corrective actions taken in the event of a temperature breach. All actions recorded within the platform and application can be downloaded to form part of the overall compliance report.

# 3.0 Project Objectives

The objective was to provide a robust IoT solution that will allow JBB to maintain and monitor (via a web browser and mobile app) critical control points within the plant, and provide configurable alerts and notifications in the event of a temperature breach within the chosen areas. Muscle cool down to be monitored over a defined time period for quality control purposes via a quick connect insertable meat probe. Data collected from the monitoring points is to be stored within a cloud platform to provide manual and automated temperature reports to meet regulatory requirements.

The project trials will include:

- Beef and Bacon Boning room - Critical temperature control point monitoring.
- Holding chiller - Critical temperature control point monitoring.
- Quality Control – Utilising Insertable Food Grade Meat Probe

# 4.0 Methodology

Constellation Technologies (CT1) engaged with client to understand their monitoring requirements and the environment in which the technology was to be installed within.

Based off those requirements we researched for a suitable enclosure to ensure extra mechanical protection to the IP67 rated IoT device, in allowance for high pressure washdown procedures, and the use of caustic-based cleaning chemicals. This also provided an area to install an IP67 M8 socket to allow for quick and simple connection of the external stainless steel meat probe. Appropriate ventilation glanding was allowed to reduce condensation build up within the internal parts of the enclosure *(Refer to Appendix A IoT Enclosure Design).*

Due to poor cellular network connectivity at site, we selected the use of LoRaWAN, low powered IoT wide area network technology that transmits over unlicensed frequency bands. The IoT devices connect to the LoRa gateway which was installed onto the company network, facilitating data transfer back to the cloud *(Refer to Appendix A IoT Network Design).*

CT1 then purchased a sample of the enclosure for installation and bench testing of the IoT solution, prior to project release.

The project was managed using agile methodology, and consisted of the following key deliverables:

- Finalising requirements including accepting criteria and final deployment checklist.
- List and procure all raw materials, components.
- Assembly of components including, food grade enclosure, meat probe, integrated with existing CT1 Gen3 IoT device.
- Integration testing with CT1 cloud, enclosure IP testing using jet spray, communications network testing at Jimbour beef to identify Telstra or Vodafone network signal strength.
- Ship to Jimbour for self-install
- Assist Jimbour with online support, provide application access, mobile access, setup users, alerts, notifications and report.

# 5.0 Project Outcomes

- Since the solution has been installed it has removed the need for manual temperature monitoring of the operation, increasing efficiency and reducing labour costs.
- Provided continuous temperature recording and reporting via the cloud platform dashboards and mobile application, including the ability to review time-based trending.
- Utilising conditional based alerts and alarms; the client can have confidence that temperatures are being maintained within the operation without the consistent need for manual temperature checks.
- Easily monitor near real-time muscle cool down temperature to ensure quality of product, and record temperature data without the need to recover the information from a data logger to a PC or third-party device.
- Automated HACCP reports via email, including refrigeration index report to key staff members.

# 6.0 Discussion

The project team approached known IoT specialists Constellation Technologies ASX:CT1 to review opportunities to assist with temperature monitoring applications. The initial report was developed by Foodability Co around Brownfield Micro Bovine Boning Room designs.

This Industry 4.0 project stood out as excellent opportunity for the inclusion of IoT technologies within plant operations, due to its low capital cost and operating overhead, with all functions being monitored by a cloud-based platform.

The current practice of manually checking temperatures throughout the plant and keeping records for QA purposes is time and labour intensive. Further to this, the ability to improve monitoring and recording of muscle cool down temperatures during the chilling process will help improve safety outcomes, and timing of product for dispatch.

Now the system is installed and functioning there are potential opportunities to explore and build on the technology foundation, to provide compressor control applications within the facility, with the potential to deliver low-cost automation of carcass chiller set points to reduce energy consumption and carcass shrinkage during the cool down process.

# 7.0 Conclusions / Recommendations

The application of IoT temperature monitoring solutions within the plant has been a significant success.

The hardware device enclosures were simple to install and did not require external power, due the long-life reachable batteries provided within the Gen3 IoT devices *(Refer to Appendix A Photo of Installed IoT Device and Food Grade Meat Probe Within the Holding Chiller).*

The IoT temperature monitoring solution automatically sends sample data to the cloud platform every 15mins, which has removed the need to perform manual temperature checks. This near real-time continuous monitoring solution has seen a cost benefit in the reduction of labour hours typically required to undertake this task.

The CT cloud platform provides JBB both a simple and convenient way to monitor all application temperatures and trends via the web dashboards or mobile application (supports both iOS and Android), within the installed process rooms *(Refer to Appendix A Example Images from CT1 Cloud Platform)*.

Parameter based alarms customised to meet the operational needs offer assurance that temperatures within both process areas are being maintained within their desired range, and if not, there is immediate notification by SMS and email so that corrective actions can be instantly taken to resolve any issues.

The external meat probe option which can be quick connected/disconnected as required to the enclosure and Gen3 IoT device provides a convenient and efficient way to visualise and report on muscle cool down temperatures to ensure safety and quality of the product *(Refer to Appendix A Photo of Insertable Food Grade Meat Probe).*

This inclusion has negated the need to use a data logger to manually collect temperature data for download to generate the report required for the refrigeration index.

This has not only improved quality and safety outcomes, but added operational efficiencies in the way that temperature data is collected, including improvement in the timing and dispatch of product.

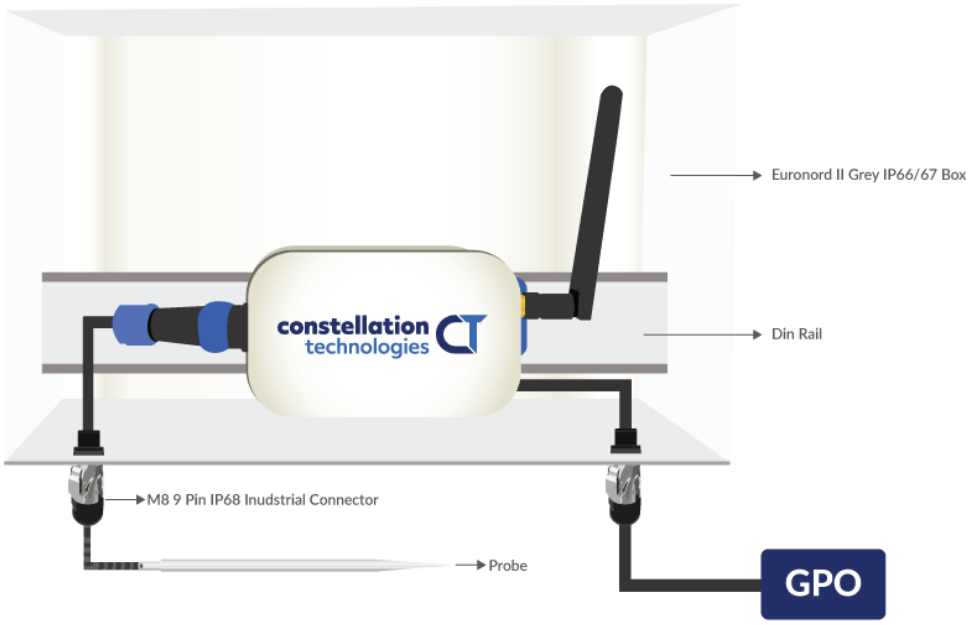
Compliance reporting has been simplified through email automation for both HACCP and refrigeration index reports.

Finally, the return on investment (ROI) based on actuals has seen a positive return of 32% savings on operating costs for manual temperature monitoring within year 1, and 86% year two *(Refer to Appendix A ROI Calculations).*

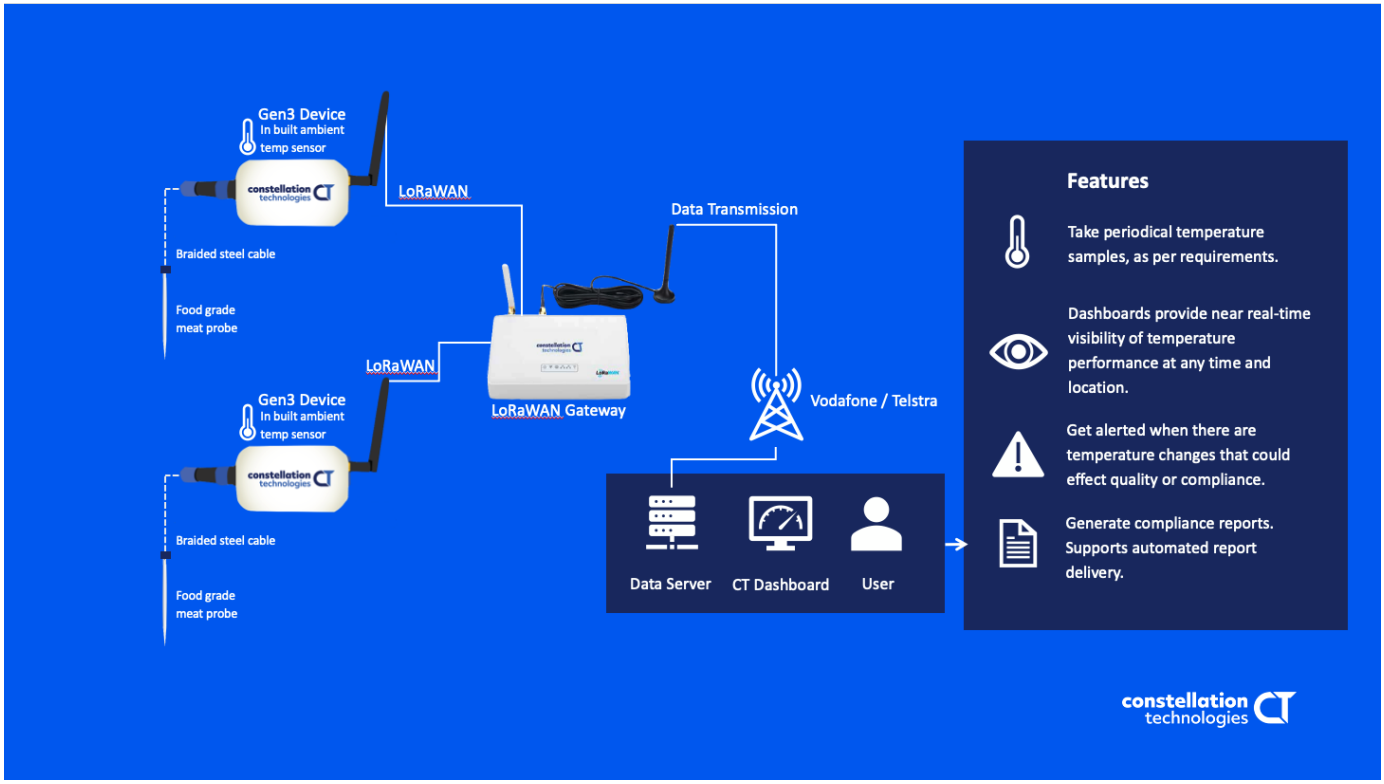
These IoT applications will not only provide increases in efficiency and decreases in overall operating cost for JBB, but they can be applied to a wide number of MSBR and abattoirs across the Australian meat industry.

# 8.0 Appendices

## 8.1 IoT Enclosure Design

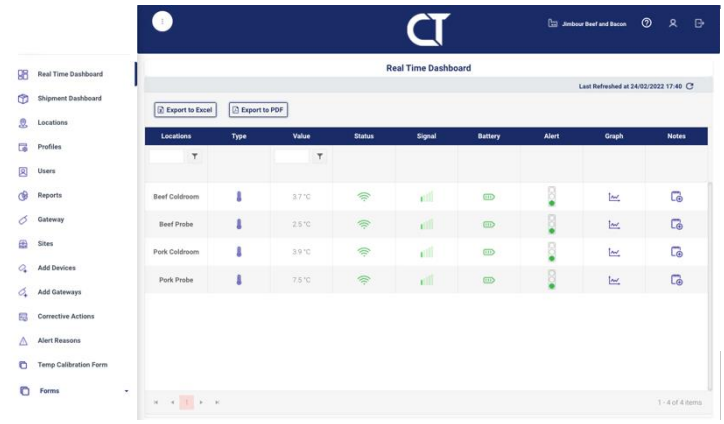



## 8.2 IoT Network Design



## 8.3 Photo of Installed IoT Device Photo and Food Grade Meat Probe Within the Holding Chiller

## 8.4 Example Images from CT1 Cloud Platform




Overall asset view dashboard. Simple traffic light-based system allows for simplistic view of the room or assets temperature status.


Drill down and view temperature trends of each asset or room.

## 8.5 Photo of Insertable Food Grade Meat Probe

## 8.6 ROI Calculations

| Project Costs Year 1 | Qty | Cost | Total |
|---|---|---|---|
| LoRaWan Gateway | 1 | $450.00 | $450.00 |
| Boning Room IoT equipment | 1 | $972.70 | $972.70 |
| Holding Chiller IoT equipment | 1 | $972.70 | $972.70 |
| Monitoring Platform Charges 12 Months (2 x Devices) | 12 | $30.00 | $360.00 |
| Gateway Data Charges | 12 | $20.00 | $240.00 |
| | | **Total** | **$2,995.40** |

| Project Costs Year 2 | Qty | Cost | Total |
|---|---|---|---|
| Monitoring Platform Charges 12 Months (2 x Devices) | 12 | $30.00 | $360.00 |
| Gateway Data Charges | 12 | $20.00 | $240.00 |
| | | **Total** | **$600.00** |

| JBB Annual Temperature Monitoring Operating Costs | Qty | Cost | Total |
|---|---|---|---|
| Operational Costs | | $35.00 | |
| Manual Temperature Monitoring Hours (Weekly) | 2.5 | | $87.50 |
| Operating Weeks Per Year | 50 | | $4,375.00 |
| | | **Total** | **$4,375.00** |

| | |
|---|---|
| **Total Savings Year 1** | **$1,379.60** |
| **ROI Year 1** | **32%** |

| | |
|---|---|
| **Total Savings Year 2** | **$3,775.00** |
| **ROI Year 2** | **86%** |