

# Stock Control Using Smart Self-Powered Weigh Bins in an Unmanned Portable Store

## Executive Summary

Inventory control of large items is relatively simple to manage and control, however, have you considered how you monitor the stock levels of small items such as screws or nuts and bolts? Regular manual stock taking is feasible, but labour intensive and can be prone to error. One solution is to use the weight of the parts as the measure of inventory and by placing the storage bins on weigh scales this is possible. It has been demonstrated that low energy BLE weigh bins, powered by indoor ambient light, can reliably be adopted to deliver real time stock data for small components in a warehouse or stockroom. Weigh scales have been designed that are powered by energy harvested ambient light and able to communicate via low power BLE to a back-end monitoring system. Field trials were performed with Codegate the developers of the G1 Unmanned Store. The G1 is a modified container that is designed to be a mobile store-room equipped with smart light powered weigh bins. The weight of storage bins was used to determine the number of parts being held in stock in real time. The advantages of using a weigh scale storage bin powered by energy harvested light is that they are very low maintenance with no requirement to change the battery at regular intervals and alleviating the need to provide mains power to individual bins in a racking and storage system. This significantly improves operational efficiency, ensures accurate stock level data and enables easy reconfiguration of the stock room or warehouse as needs change.



## Introduction

All businesses are seeking to minimise costs and make efficiency gains in order to improve profits or better utilise available funds to allow for investment. One aspect of a business especially in manufacturing or a supply business is to have sufficient stock to satisfy orders for customers, but not too much inventory that valuable capital is being tied up unnecessarily. So, how do companies manage stock control? Experience goes along way, the application of accurate forecasts, regular stock taking to inform purchase and demand decisions are all fine. However, they are not real time, require manual intervention and as industry embraces 'just in time' and 'digital twin' concepts a more automated system is required. This is especially true when the 'stock' you wish to control is on a construction site and the parts to be stocked are small and numerous e.g. nuts and bolts or washers for example. Innovate UK funded an 18-month project for Lightricity and Codegate to develop and field test a self-powered automated weigh bin inventory control system.

So what system is currently used and why is there a requirement for a more advanced system? One commonly adopted methodology is the "*Two or Dual Bin System*". This works by having two 'bins' that are used to store the same part or component. Both bins start full and stock is removed from bin 1, and when bin 1 is empty there is a 'form on the bottom of the bin to order new stock, whilst bin 1 is being restocked, inventory is taken from bin 2 and so on and so forth.

## Weigh Bin Requirements and Competitor Solutions:

There are a number of requirements for this use case, the first is that whatever system is designed it must be robust in a storeroom/warehouse setting, be reliable both in terms of the accuracy of the weighing system and hence stock level and also operate 24/7 and be convenient to use by those needing to remove items from stock. Where RFID offers a solution for larger devices, it is not a practical solution for small parts such as screws, nails, nuts and bolts and even for large items relies on the user logging out the item and logging it back in when/if returned.

Clearly weigh scales have been available and affordable for many years, as most people have at least one set in their homes. These are generally battery powered, but as they are used infrequently and for a short space of time battery lifetime is acceptable. However, considering this use case, the scales are required to monitor the weight of the bins and their contents regularly, and so battery powered systems are far from ideal. It is of course feasible to use mains powered scales, but this comes at a cost, both in terms of installation and for the electricity required.

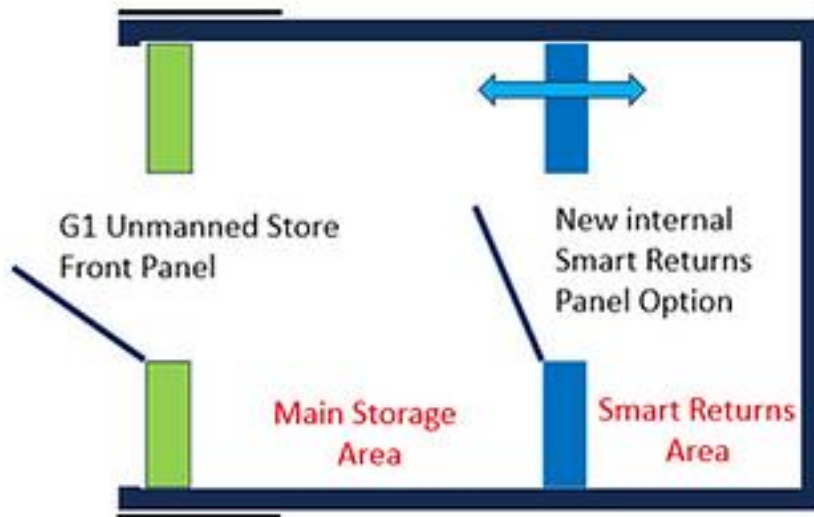
Wouldn't it be great if you could power the system by harvesting the ambient light in the warehouse/stockroom and alleviate the need for batteries or mains power? One important aspect of this trial was to establish the reliability of the light powered scales. If proven to operate reliably under variable and low light conditions, light energy harvester powered weigh bins would offer significant lifetime cost benefits, alleviating the need for main power or batteries and eliminating the inherent costs of battery changes offering significant cost and performance benefits (reference: [Whitepapers | Lightricity Ltd](#)).

## Field Trials:

### Unmanned Storeroom e.g. on a construction site:

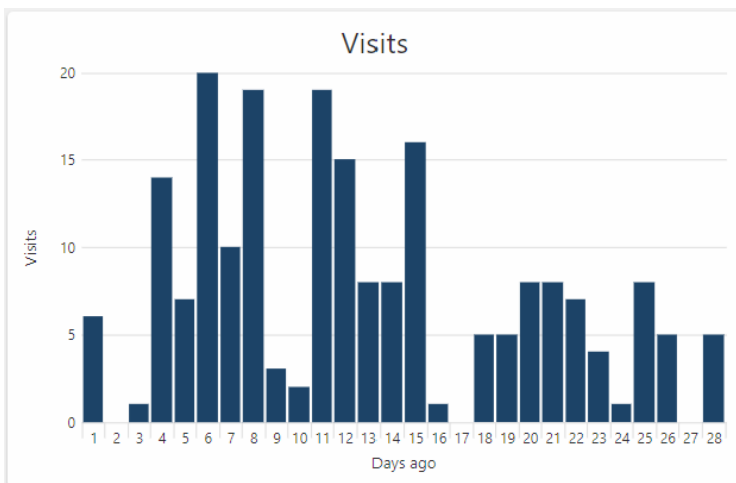
Have you considered how you would manage the stock of small items such as nuts, bolts, washers, screws, nails on a construction or building site? The challenges are (1) there is seldom a dedicated store manager as you would find on a permanent premises or in a factory and (2) there is no infrastructure available to deliver a storeroom service.

During this field trial a shipping container was converted to an onsite self-managing stockroom. The 'off grid' container is powered entirely by wind and solar (Codegate G1 Unmanned Store: <https://youtu.be/MNz3cEPhZ5s> ). The LuxBase weigh bin reports the quantity of parts in any storage bin automatically over its operating life without batteries or a power supply. As it is an integral part of a moveable container it can be placed anywhere and additionally is easily retrofitted into existing storage arrangement.



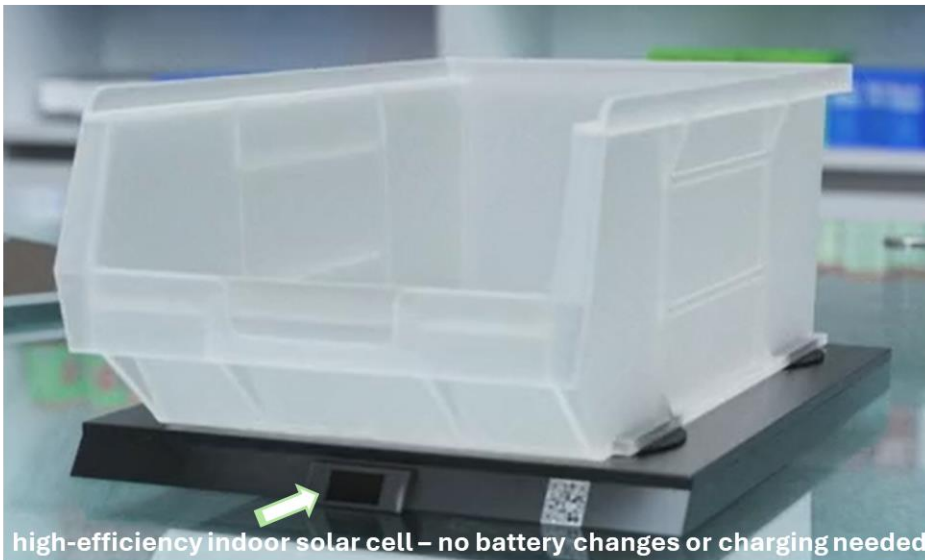
“Using just one G1 Unmanned store we have reduced our tooling re-purchases by 30% per year, stock losses are down 80%, and our store management costs have dropped 3%, all from an initial 16-month return on investment.”

*Tony Lawless, Store Manager - DS Smith*

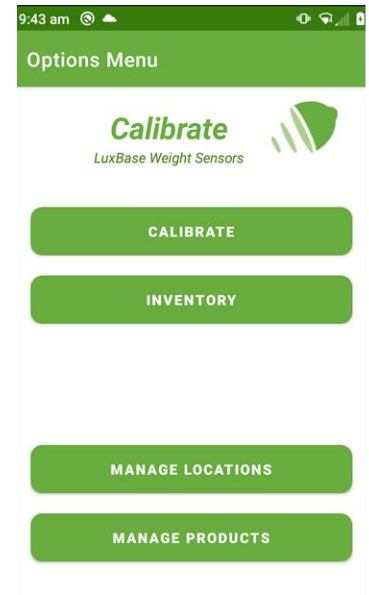


Calibrated via a mobile app and powered by a tiny high-efficiency solar cell, the unit sends readings over very low power BLE to a low-cost receiver, picking up readings from hundreds of sensors in close proximity, and relays the data back to web-based monitoring software. This alleviates the requirement for users to manually log parts in and out of the store and offers real-time inventory control and management.

**LuxBase: Smart self-powered weigh bin – wireless & zero maintenance:**



**Mobile device app – easy management:**



**Cloud dashboard – always up to date inventory:**

Codegate		Old Barn		Dashboard			
Store Hire	Product Type	Status	Search				
1234	Replenishable	- Show All -	<input type="text"/>				
Product Type	Product Code	Description	Reference	Check Date	Damaged	Qty	Status
Replenishable	AA Battery	AA Battery				20	In Store

LuxBase removes the need for manual stock reporting, delivers much greater accuracy, and could be used with analytical software to predict timely re-ordering and replenishment, thereby improving efficiency and preventing delays due to parts not being available.

*Richard Tuckey, Commercial Manager at Network Rail* commented that “Having an automated stock system removes the need for users to manually report usage and enables re-ordering to be completed in a timely manner, ensuring that material stock levels are correct and that materials are available for use when required and stock rotation is adhered to and maintained.

Additionally, an automated stock system assists with stocktaking and enables the auditor to complete this task quickly and more efficiently. Thereby enabling them to be more productive by completing the audits quickly and freeing them to undertake other tasks.”

## In Summary

Lightricity and Codegate have designed and developed weigh scales that are powered by energy harvested ambient light, whether that be from an indoor or outdoor source. These LuxBase weigh scales are commercially available as standalone items or as part of the G1 Unmanned Store system.

When combined with stock room bins, it has been demonstrated in extensive field trials that light powered weigh bins can reliably and accurately be used for inventory and stock monitoring. When combined with wireless communications the stock level can be communicated in real time to a stock management system, without the need for human intervention or manual stock taking.

The weigh bin solution complements the G1 unmanned store perfectly, allowing ease of stock control on remote sites where it is not viable to have a stock manager on site.

This innovative solution enables flexibility in the location of the bins, in fact we are currently evaluating if this system can be adapted for use in vehicles used by service engineers and could lead to the van of the future. Keep watching for more information on this and other use cases currently under trial.

The benefits of real time stock information for small and numerous parts can lead to reliable satisfaction of demand, reduction in the overstocking of parts all leading to efficiency and cost savings for the business.

**Lightricity PV technology**

Our technology is the world's most efficient indoor PV technology (though it works outdoors too). It converts indoor light sources to energy with up to 35% efficiency – a more than six-fold improvement on conventional PV, as validated by the UK's National Physical Laboratory (NPL).

A panel the size of your fingertip will power your IoT device forever. Even in extremely low indoor light. Our technology can be sealed in the device and operate at temperatures from -40 to +200 degrees, opening possibilities to power devices not previously thought possible with indoor IoT.

We offer two solutions. For those designing new connected devices, our customisable PV panels can be integrated into any low-power IoT device as an alternative to batteries. For IoT systems integrators, we offer off-the-shelf, easy-to-integrate, completely battery-free PV-powered sensors for many common measurement and tracking applications.

**Codegate – Traceability and Accountability in a Connected World**

Codegate help businesses track people, products, and services. Our multi-skilled software development team can tailor solutions to specific customer requirements in virtually any business sector.

Codegate's automated tracking software products include the G1 Unmanned Store and Lime track & trace middleware, which supports Barcodes, NFC, RFID, BLE, GPS and UWB real time tracking technologies.