People Counting Systems – Evaluating A Tender

As well as the business aspects of a tender for a counting application, there are several technical aspects that reviewers should be aware of. This white paper discusses those technical aspects in detail. These can be divided into the following areas:

- **Performance**
- **Data format, access, etc**
- **Maintenance and support**
- **Miscellaneous items**

These areas are covered in detail below.

Performance

The primary performance criteria is the accuracy of the counts. All vendors claim to deliver high accuracy. But without understanding how they measure accuracy, that in itself doesn't say much. Moreover, it is important to use the same measure of accuracy when comparing alternatives and, in particular, to use a measure relevant to the end user's application.

We can divide measures of accuracy used by various vendors into three categories:

1. **Ones that are completely bogus.**
2. **Ones that are valid but too restrictive to be useful.**
3. **Ones that are valid and relevant.**

An example of a bogus measure is from a vendor of infra-red counters who claimed 98% accuracy in a retail environment on the basis of the difference between daily in counts and daily out counts for the store being below 2%.

Continued on the next page.

Countculture

Preformance (cont.)

This is bogus because it ignores common mode errors, that is things that affect both in-counts and out-counts equally. For example, a system that only counts every second person would be 100% accurate by this measure, but the counts are actually only 50% accurate.

Another example of a bogus measure was used by a no-longer-in-existence UK counting vendor, who defined accuracy as the observed count divided by the true count. So if the observed count is twice the true count, the system is 200% accurate! Whatever that means. Less obvious if they can ensure that the system is always overcounting, then the accuracy is consistently above 95% or whatever they are claiming.

An example of a valid but too restrictive measure is where a vendor makes a claim but adds caveats on the conditions, such as a light-beam vendor claiming high accuracy but only where the sensor components are less than 1m apart, all people are singulated, and the traffic count is less than 100 people per hour. A favourite of video-based system vendors is adding caveats around uniform lighting, etc. Such restrictions render the accuracy claims invalid if the operating conditions of your application are excluded. When it comes down to it, the most useful valid measure of accuracy is derived from the difference between the observed count and the true count divided by the true count, namely **Accuracy = 1 - |O - T| /T**

Where O is the observed count (the value reported by the system), and T is the true count (the actual count). This is made relevant by measuring the counts over the smallest time intervals that are going to be used since accuracy over longer intervals doesn't guarantee accuracy over shorter intervals. For example, a vendor claiming 95% accurate daily counts may have achieved it by tuning the system so it overcounts in the morning and undercounts in the afternoon to achieve the target. But if hourly counts are needed for rostering, say, the accuracy of those will be much less.

Countculture

Preformance (cont.)

- **Is the vendor just quoting the claims of their device supplier? Such claims are likely to be generic and come with unknown caveats.**
- **Will the vendor supply an accuracy guarantee? Is that backed up with an accuracy report for each location based on established ground-truth? What is the accuracy of the ground-truth?**
- **If the vendor cannot supply proof of accuracy, is it feasible to measure the accuracy independently?**

Many systems can supply other data as well as counts, e.g., attributes such as object classification in a smart cities application. These are subject to their own levels of accuracy, and similar questions need to be asked.

···

Data Format, Access, etc

A counting system can be thought of as a collection of edge devices (sensors) generating a stream of data (counts) which needs to be collected and stored and made accessible to the end users. Questions that should be asked about this include:

- Is the data binned or aggregated in some way before being made available, or is each individual count a separate data item?
- Is the data provided the raw sensor data or is it manipulated along the way? For example, is the raw data smoothed to remove anomalies and spikes? And if so how is it ensured that valid unusual data is not eliminated?
- What is the lag between an object being counted by a sensor and the corresponding data item being made available? Is it near real-time or next business day?
- Is the vendor providing just the sensors and the means to stream the data, or a more complete package that does the wrangling of the edge device feeds and provides a combined stream of all data? Are there associated reporting tools? And to what extent are they customisable?

Countculture

Data Format, Access, etc (cont.)

- Who owns the generated data? And who has access to it? What other purposes will the vendor use the data for?
- Who will control/own the servers and hence the data? Is it the user (on-prem or in their own cloud instance) or a vendor-supplied cloud service?

···

Maintenance and Support

A counting system, being a collection of computing networking resources, is going to have failures. There will also be changes over time, such as the addition of new sensors, removal and relocation of sensors, etc. Some important questions regarding this are:

- Who will be responsible for monitoring the system to detect edge device failures? As part of the solution, does the vendor provide pro-active monitoring? Or is up to the end user to detect and notify the vendor? Does the maintenance agreement cover installation of a replacement?
- If the system is video-based, then the cameras will need regular cleaning. Is this part of the maintenance agreement?
- What will be the vendor's approach when an end-user raises concerns about data accuracy?

···

Countculture

Miscellaneous Items

While the above are the main areas that need to be looked at, there are a number of auxiliary areas that are also worth evaluating a tender against:

- The different locations where counting is required vary significantly. Does the vendor's product have the flexibility to adapt to all of these locations? Or is it more rigid in applicability so may not be deployable in some locations or its accuracy will drop accordingly.
- Most devices have a number of parameters the control its behaviour. Does the vendor propose tuning them to adapt the device to a given location? Is this just the basic controls like drawing a counting line or zone? What is the process for tuning and how long will the vendor spend per device?
- At an outdoor location, how does the device handle adverse weather such as bright sunshine or rain?

Please visit www.countculture.com
or contact info@countculture.com
for more information,

Countculture