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What is ICU?

ICU utilises Facial Recognition technology to provide useful tools for end users. The core objective for ICU is to provide **affordable** and **easy to use** technology that can be easily integrated to meet the customers own needs.

ITL provide the tools for easy customisability so that a vast array of applications can be provided for.

ICU is a combination of [ICU devices](#) (hardware) and an [on-line account](#) to manage the operation.

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What is ICU Device?

The ICU device is the physical hardware unit. The [facial recognition algorithm](#) runs locally on each device – this ensures that the process of recognition is very quick (at least 5fps). The device can also be used to control external equipment using the various [interfaces](#) available on the unit.



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What are the markets for ICU?

The ICU product has great potential across many market sectors.

These include but are not limited to retail, gaming, access control, targeted advertising and security. Within these broad definitions specific applications exists.

For example, access control ranges from access to buildings/secure safes/machinery to counting and specifying individuals that pass a certain area. It is important to note this is all contactless.

Gaming markets include age verification as well as identifying excluded and premium users.

Within retail, ICU can be customised to implement loyalty schemes, provide a tool to investigate customer demographics as well as automated age verification.

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What does the ICU Face algorithm do?

The algorithm very simply converts a face into a [FaceID](#).

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What is the FaceID?

The FaceID is a large number which describes a face. The FaceID consists of 512 numbers. It is not possible to reproduce the face image from the FaceID.

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What facial recognition technology do you use?

We use our own algorithm which was developed in ITL. The algorithm uses a CNN (Convolved Neural Network) model which we have trained with over 6 million images. We continuously refine and improve the algorithm, to ensure we have a world leading solution to facial recognition. Updates are easily available to all customers and are accessed through the users [online account](#).

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What do you mean by *Training the Algorithm*?

A neural network model is a computer algorithm that is based on the human brain. The model is trained or learns from information presented to it. For example, for age estimation the model is trained using millions of images of faces of known ages. The model is presented with images of a subject (often many images of the same person at different ages). The algorithm analyses the features of the person and associates that with the known age. It does this for millions of images. In doing so, the algorithm essentially learns what feature a subject typically has for a certain age. So, when a new image is presented to the ICU, the algorithm analyses the features, and from what it has learnt, it estimates an age based on what age it has associated with those features.

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What affects the quality of the algorithm?

The algorithm is ultimately limited by the quality of the training data. The more good training data you have the better the performance of the algorithm. Therefore, for facial recognition is vitally important that the algorithm is trained using diverse faces (gender, ethnicity, ages, poses, emotions etc). If the algorithm is not trained with such diversity, then bias will be inherent. For example, if the algorithm is trained on primarily middle age Caucasian males, then it will ultimately perform better for middle age Caucasian males and not as well for other cohorts.

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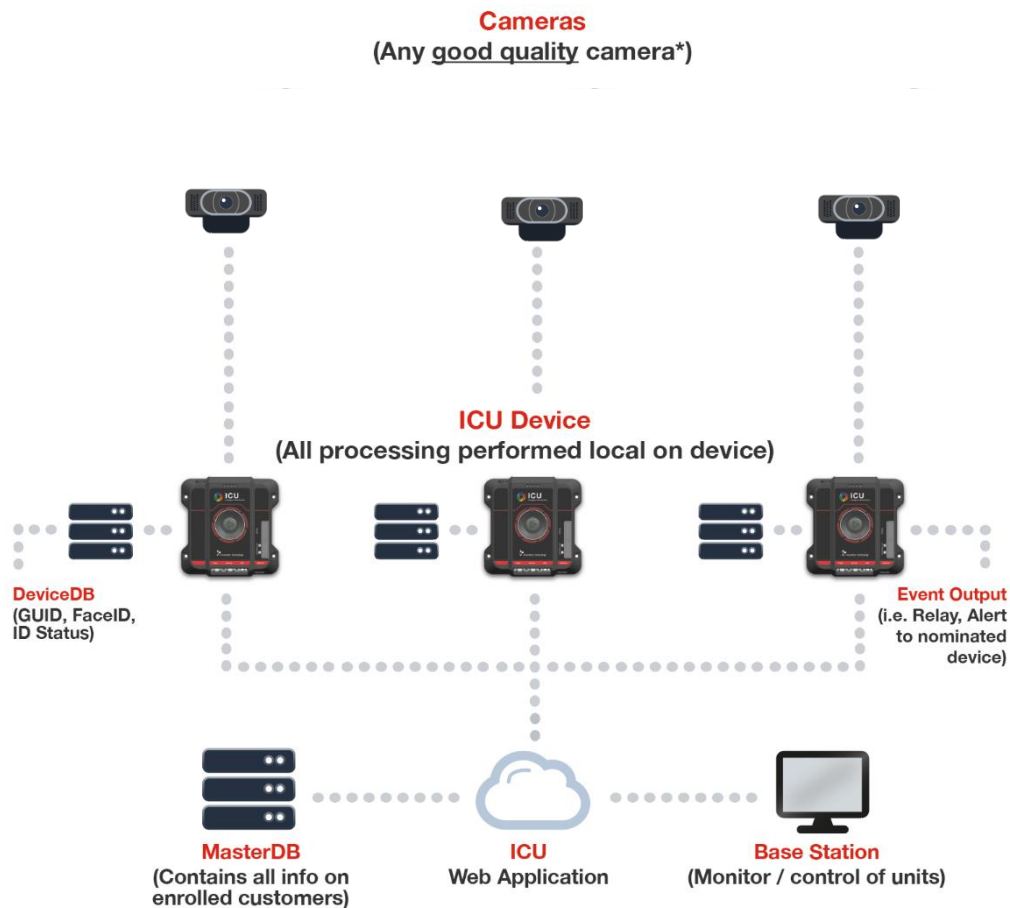
What is ICU Face on-line account?

The ICU Face on-line account can be accessed by any browser (Chrome* (Chrome is the recommended browser), IE, Mozilla, Safari). ITL will provide the customer with a login email and password. From this login the customer can access the ICU Dashboard from which they can set up their [Device](#) to operate for their specific application.

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How is ICU designed to operate?

A customer will get access to their own on-line account. From this account the customer will be able to add as many ICU devices as they like. They will also be able to add Members, define Groups and assign Actions to each connected device. Software updates are all managed from this account. The customer can log into their account using any browser enabled device.



*Quality of output will depend on quality of the input

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What cameras can I use?

You can use up to 2 USB cameras with each ICU Device. The choice of camera will depend on the customers application. Support will be available from ITL to help the customer chose the most appropriate camera.

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Is there spoof detection?

We are developing our own spoof detection methods. These are not yet available. The methods include 2D detection (monitor reflections from a 2D surface), liveness detection (blink detection, mouth movement), requested response (ask the user to respond to a gesture request) and landmark tracking (monitor how facial landmark positions move with relatively to each other). These updates will be rolled out as a software update to the unit and will be available incrementally in the coming months.

It is also important to point out, we do not just acquire 1 image at 1 point in time. We are continuously monitoring the user in front of the camera. For example, to spoof a gaming machine the user would need to stand in front of the unit with an image in front of their face for the entire transaction.

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What are the members, actions and groups?

- *Members* are the user faces which the customer adds/enrolls to their account.
- *Groups* are a defined status which members are assigned to (i.e Premium group, excluded group etc).
- *Actions* are defined outputs which each [Device](#) can be configured to perform in response to a specific *group* (i.e disable a machine if excluded member detected).

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How many Groups can I have?

The customer can create their own groups. There is no limitation on the number of groups the customer can create. The default group on all devices is enrolled. This means a member has been created.

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Do you save personal details on the Device?

No. The device only contains a [GUID](#) (unique reference to a database entry), [FaceID](#) (a large number which describes a person's face) and a Group ID (reference to any specific group the person is assigned to). There are no images or personal information (i.e Name, DOB) saved on the unit.

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Where are personal details kept?

Personal details, such as images and names are stored securely in the cloud ([master database](#)). The details are identified by the [GUID](#) which is sent by the device once a known person is recognised. The details are then passed to the [account](#) of the customer and **not** back to the [device](#).

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What is the master database?

The master database contains all information on a particular member. This can include their name, age and image. The master database also contains all the information contained in the device database. Both databases are linked via the GUID.

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What is the Device database?

The Device database is a database that is stored on every device linked to an account. It contains a GUID, a FaceID and a GroupID. There is no personal information in the Device database, however it does contain enough information to identify a face and to react to that FaceID depending on the GroupID (i.e if on a excluded list disable the machine).

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What is the GUID?

The GUID is a unique reference to an entry in a database. Each Member will have their own unique GUID. This is typically kb in size.

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What output interfaces are on the ICU Device?

The ICU device was designed with a number of different output interfaces in order to ease integration of the unit. These are:

2 Control outputs (12V) – can be used to trigger external devices such as gates, lights, relays etc

Serial connection - Can be used to connect to devices with serial ports. Can communicate via SSP. For example, can be used to directly control ITL validators (eg NV9, SMART Coin system)

Ethernet – Can be used to send alerts to customers own software via JSON POSTs.

Expansion Port – Located internally in the unit. This can be used by customer to add their own PCB boards i.e Bespoke communication protocol, additional comms (i.e Cellular, WIFI). This allows the customer to add their own USP to ICU Face.



How do I add faces?

Faces are added to the customer's [account](#). This is done by adding images via the account dashboard. Once the image is added, personal details and notes can also be added. This information gets saved in the [master database](#), while the [GUID](#) and [FaceID](#) gets shared with all [device](#) units linked to the customer's [account](#).

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Does ICU need a constant internet connection?

To utilise the full capabilities of ICU Face an internet connection is recommended. However, the [device unit](#) can work independent of an internet connection. The unit can use the [Device database](#) in order to determine how to react to a face. However, with no internet connection the unit cannot retrieve personal details, or can it send alerts. New users or any updated information from the [user account](#) **cannot** be shared with the [Device](#) if there is no active internet connection.

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Do I need an internet connection?

The internet connection is used to

- Register a new [Device](#) to your [account](#)
- Add new [Member](#)
- Retrieve personal details of a [Member](#)
- Ensure units are up to date (Firmware and synced with [master database](#))
- Send Alerts via [JSON POST](#)

The unit can operate [without internet connection](#) using the local database on the device. The unit will still [react](#) to the [member](#) and perform the configured action for that [group](#).

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Can I integrate with my own software?

Yes. The ICU device can be easily configured to send a [JSON POST](#) to any specified URL. This means that the information regarding any detected face can be easily sent to the users software, from which they can then interpret the result and act accordingly.

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I have my own database; can I use it?

Yes. You can use the ICU [Device](#) to send information on the [Member](#) detected by the [Device](#). The information is in the form of a [JSON POST](#) and can be sent to a specified URL which the customer can interpret and use to query their own database. However, it's the responsibility of the customer to maintain and ensure their database is up to date.

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What is a JSON POST?

A JSON POST is a method that ICU uses in order to communicate with a customer's own software.

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Is there a software only solution?

We offer both. The decision between hardware/software and software solution depends on the needs of the customer.

For example, in a situation where physically connecting the end user to some hardware is not feasible then we can offer a software only option (i.e Age Verification to access specific websites). Our software solution is allowing access to an [API](#).

However, this does require far more management and development from the customers point of view. Simply, the customer would send an image to the API and ITL would return an age estimate and/or a [FaceID](#). The customer is responsible to act/react to this data.

The customer would also **not benefit** from the [many advantages](#) of having an [ICU Device](#).

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What is an API?

An API stands for Application Program Interface. Very simply, it is a method which two different software programs can talk to each other. For ICU, we would provide an API for a [software only](#) solution – this is where the customers own software would be able to access our [algorithms](#) in order to return an age verification and/or facial recognition capabilities.

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What is the advantage of having the hardware?

The core objective when developing ICU was to provide a solution that was **affordable**, **accurate** and **easy to use**. Many competitors provide access to an [API](#) – which essentially is access to the facial recognition algorithm.

While this solution is beneficial to the provider, it does expect a large amount of effort from the customer. This includes managing the data sent to the API, managing the data returned from the API,

managing the [groupings](#) of [members](#), maintaining the database, building and managing the [interfacing](#) with external devices.

Since data is sent to an [API](#) and outputs are sent back from the [API](#), speed can be an issue. Internet [connectivity is essential](#), and the quality of the connection will impact the performance of the solution.

We have built a hardware in order to confront the many barriers customers face with a software only solution. The facial recognition processing is all done locally on the [ICU device device](#). This means that the [ICU device](#) can [react immediately](#) to any specific face – it does not rely on an [internet connection](#) in order to respond.

The hardware also conditions the data – this means that the data is processed before getting sent to the [algorithm](#) recognition. This ensures that the only the optimal data is processed, which ensures that the best results are achieved.

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How quick is it?

The [ICU device](#) recognises faces approximately 5 times a second. The [ICU device](#) will react at this speed to any specific user. For example, If you have an [Member](#) who was part of a excluded [Group](#), then the unit will [immediately react](#) to the threat (for example disable a host machine via its GPIO or usable an ITL validator via the 16-way serial port). Once the [member](#) is on the [Device Database](#), this process can work [completely off-line](#) (which mitigates the risk of a poor-quality internet connection).

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How accurate is ICU?

The quality of the outputs depends on the quality of the [inputs](#). ICU performs several steps to ensure that the inputs are of a certain quality to ensure the outputs are optimal. These include Face size filter, Pose filter and a blur filter.

ITL have performed a number of tests on images that are not optimised. For example, on Label faces in the wild. This is a publicly available test which developers can use to test their algorithm. ICU has scored an accuracy of 99.8% which is the best performing algorithm world-wide. ITL will also test on NIST. These tests are more academic in nature and as such is not an overall indication of the performance of the unit as a customer product.

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Can I add additional interfaces and/or connectivity?

ITL have provided an expansion slot in the ICU Device. The customer can add additional PCBs in order to further customize the ICU Face to their specific application. This also gives the customer the ability to add USP (unique selling point) to the device, and would in the case of an OEM, discourage their

customers from buying directly from ITL. For ITL, this means we can produce an identical product for every customer.

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What type of transistors do you use in the ControlOUT interface?

The controlOUT interfaces on the ICU Device uses bottom side NFETs.

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What terminals are pins 3, 4, 5 and 6 connected to (drain/source)?

Pins 3, 4, 5, 6 are connected to the drain of the transistors and sink current to 0V to drive the load, power should be provided from pins 2 or 7 to the opposite end of the relay.

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Are the transistors protected internally or is it necessary to use diodes when they control a solenoid or coil.

There is a current re-circulating diode on the PCB to protect the FET from any fly back voltages when driving an inductive load.

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What is the Max current in direct mode.

The coil drive circuit is protected with a 1.85Ahold 3.8Atrip PTC and is shared for both Solenoid drivers.

The FETs are rated to 10A continuous operation but would be limited by the PTC fuse.

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What is the V_{out} of pins 2 and 7

Pins 2&7 voltage is derived from the main DC supply voltage.

There is Schottky diode volt drop due to the reverse polarity protection.

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