Digital Age Assurance Portfolio
Age Estimation for Retail

Fujitsu's Digital Age Assurance solutions address the growing need for trusted digital assurance when evaluating eligibility for age restricted products and services.

Within the portfolio, Fujitsu provide two core solutions, Age Estimation and Age Verification, both of which can be tailored depending on a retailer's feature preferences.

Age Estimation Solution
Frictionless: Age estimation occurs discreetly throughout the transaction
Interoperable: Age estimation is configurable to provide an E2E solution for retail age assurance
Privacy by design: On-device & offline age estimation ensures no personal data is stored or transmitted

Fujitsu's Age Estimation Solution

Fujitsu's Age Estimation Solution uses AI-based technology to estimate a person's age from a picture or video of their face, and can run either offline, on an edge device, or online.

It can either be used standalone, or in tandem with Fujitsu's Age Verification solution (which allows those failing the set age estimation threshold to continue with a transaction using Fujitsu's Digital Proof of Age certificate).

The Age Estimation solution has been developed with AI ethics in mind; it is not capable of identifying an individual and does not make use of biometric data or facial recognition technology.

Rather, it performs image analysis and estimates the age of a person based on the visual appearance of their face. No images of customers are retained by the solution.

Age Estimation for Retail

Fujitsu's Age Estimation for Retail solution is designed for the retail environment by configuring AI Software deployed at self-checkout devices (SCO) and point of sales (POS) to instantly and rapidly estimate customers' age based on images obtained from connected cameras.

The solution is packaged as a Microsoft Windows® or Linux-based component designed to run as a service on edge devices, providing real time, anonymized customer age estimation.

Age estimation occurs on-device: images never leave the self-checkout device or point of sales, since all processing is done locally.

The local edge software gives a retailer control of the overall user journey within the confines of their checkout, without the need to call-out to an external service provider. This removes the dependency on 3rd party cloud services or additional network connectivity.

Technical Overview

Overview	Age Estimation for Retail gives retailers the ability to determine the age entitlement of their customers simply, securely, and quickly – all without the need for network connectivity or the availability of cloud services. Age Estimation for Retail can be deployed as an age estimation component only or as part of the broader Fujitsu Age Assurance solution.
Software Description	**Standard** Age Estimation for Retail is delivered as a Microsoft Windows®- or Linux-based component to be run as a service on self-checkout devices. **Optional** Age Estimation can also be deployed with Fujitsu's Age Verification solution via an additional component that runs alongside the Age Estimation service.
Service Options	The following service options are available. • Enhanced support level beyond the standard SLAs • Enhanced configuration support beyond the standard Age Estimation for Retail offering
Deliverables	Fujitsu will provide the following deliverables. • Executable file and configuration to be installed as a service • Integration guide • Standard support
Conditions and Exceptions	The customer is responsible for providing the following services (unless contracted via another service). • Supplying and installation of appropriate camera • Configuration of initiation file • Sandbox or development environment The service assumes. • A retailer has the ability to modify their checkout software to initiate Fujitsu's Age Estimation for Retail software. • A POS / SCO that is configurable to integrate a Windows- or Linux-based component Prior to this service commencing, each customer must complete the corresponding on-boarding offering to ensure that the service is ready for support.

Age Estimation for Retail Self Check Out in Practice

Fujitsu's Age Estimation for Retail solution is for retailers, designed for a seamless and frictionless experience through a customer's journey.

The solution is made up of several features, which when combined support the desired customer experience. The retailer has control on how to bring together the features and configure the solution.

Fujitsu provide a typical customer journey through a Self-Checkout environment as follows:

Passive Age Estimation

This is the default estimation method and begins as soon as the Age Estimation software is initiated for each shopping transaction. The Age Estimation solution uses the default camera to retrieve images of the customer and age estimates these in readiness for an age restricted good being scanned.

On scanning of an age restricted item, an age check request will return the estimated age without alerting the customer or interrupting the checkout process if it is above a retailers configured age threshold (for example, 25 years old for Challenge 25)

Liveness checking

The solution performs passive liveness checking during the shopping transaction, ensuring that the system cannot be spoofed by holding a physical photo of an adult, or a phone or tablet displaying either a photo or video, up to the camera.
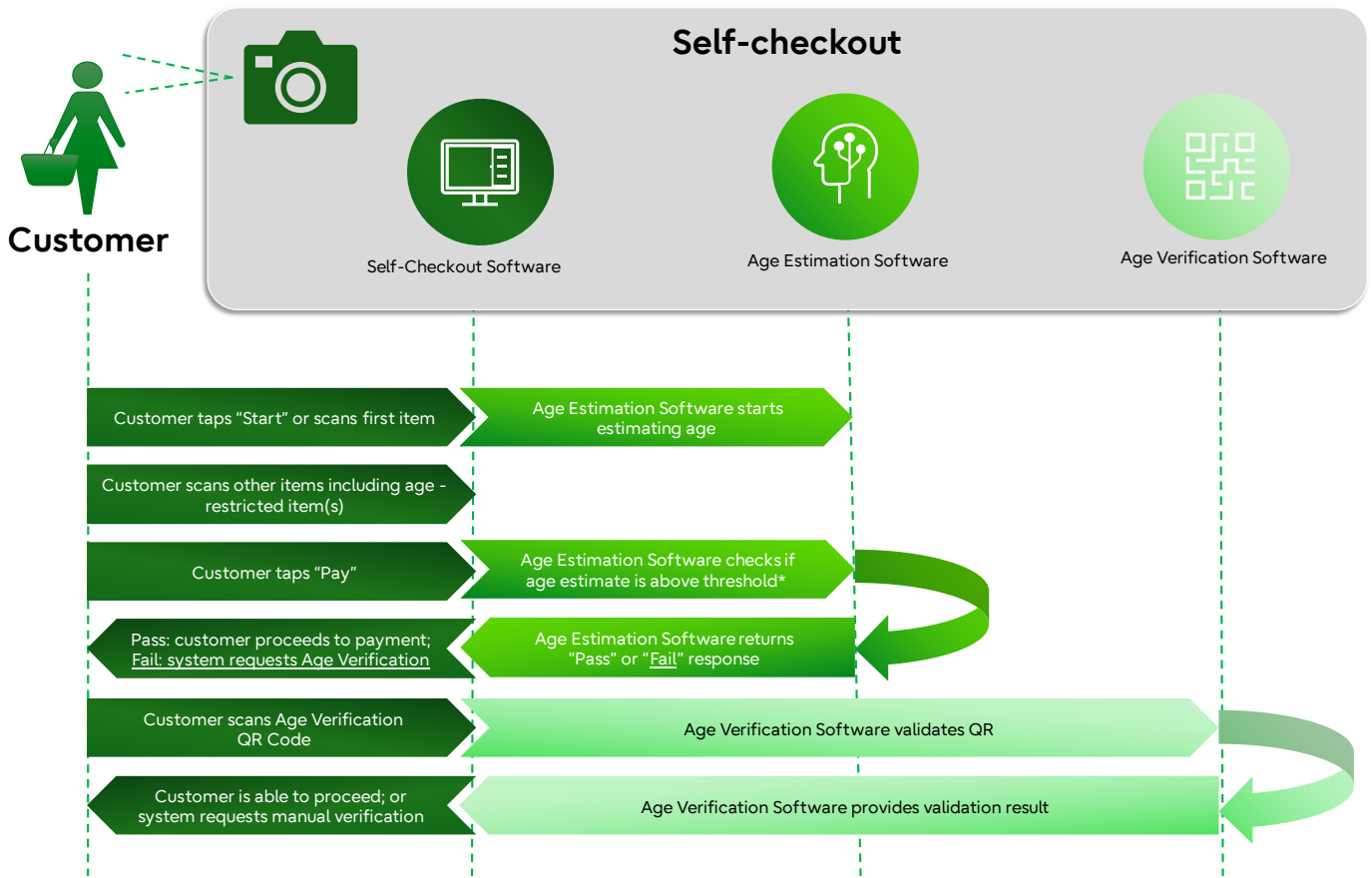
Multiple Faces

Fujitsu have developed a proprietary algorithm that combines face tracking with filtering based on face size and centre-pose to eliminate background faces and only focus on customers involved in the transaction. By default, if one of the individuals involved in the transaction is estimated as below the threshold age then age verification will be required.

Age Estimation Solution sequencing flow

This section provides detail on the process flow and handoffs between the different technical components of the solution.

The diagram below also shows how the Age Estimation Solution can work in tandem with the Age Verification Solution.   If Age Estimation is not able to confidently determine that the customer is above the threshold age (e.g., 25-years-old), the customer can be given the option to prove their age using Fujitsu's Age Verification Solution.
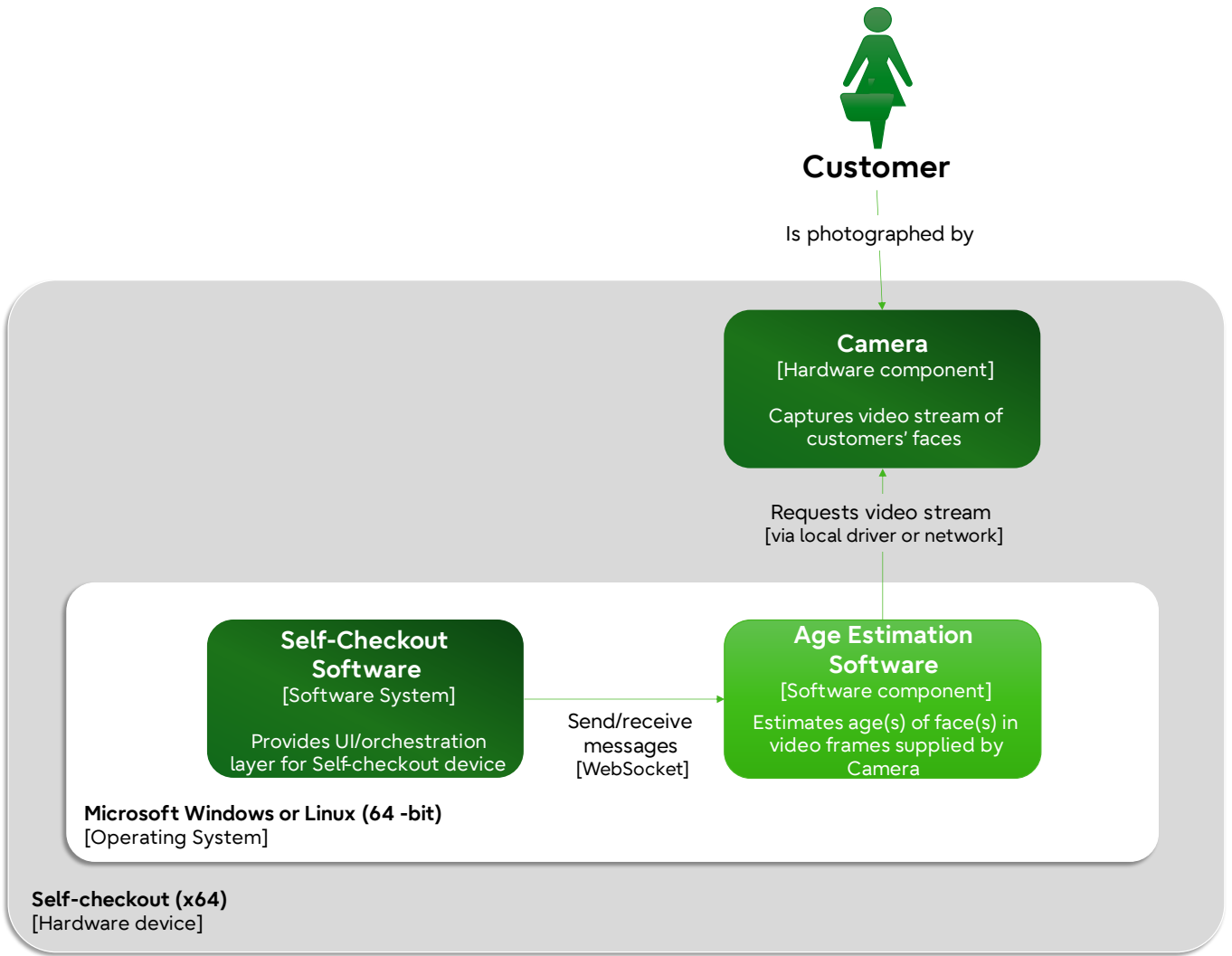

Self-checkout

Customer

Self-Checkout Software

Age Estimation Software

Age Verification Software

Customer taps "Start" or scans first item	Age Estimation Software starts estimating age
Customer scans other items including age - restricted item(s)	
Customer taps "Pay"	Age Estimation Software checks if age estimate is above threshold*
Pass: customer proceeds to payment; Fail: system requests Age Verification	Age Estimation Software returns "Pass" or "Fail" response
Customer scans Age Verification QR Code	Age Verification Software validates QR
Customer is able to proceed; or system requests manual verification	Age Verification Software provides validation result

*alternatively, age check can take place at when age-restricted item is scanned

Solution Context diagrams

The following solution context diagram below provides detail on how the Age Estimation for Retail solution components interact.

Age Estimation for Retail SCO

Customer

Is photographed by

Camera
[Hardware component]

Captures video stream of customers' faces

Requests video stream
[via local driver or network]

Self-Checkout Software
[Software System]

Provides UI/orchestration layer for Self-checkout device

Send/receive messages
[WebSocket]

Age Estimation Software
[Software component]

Estimates age(s) of face(s) in video frames supplied by Camera

Microsoft Windows or Linux (64 -bit)
[Operating System]

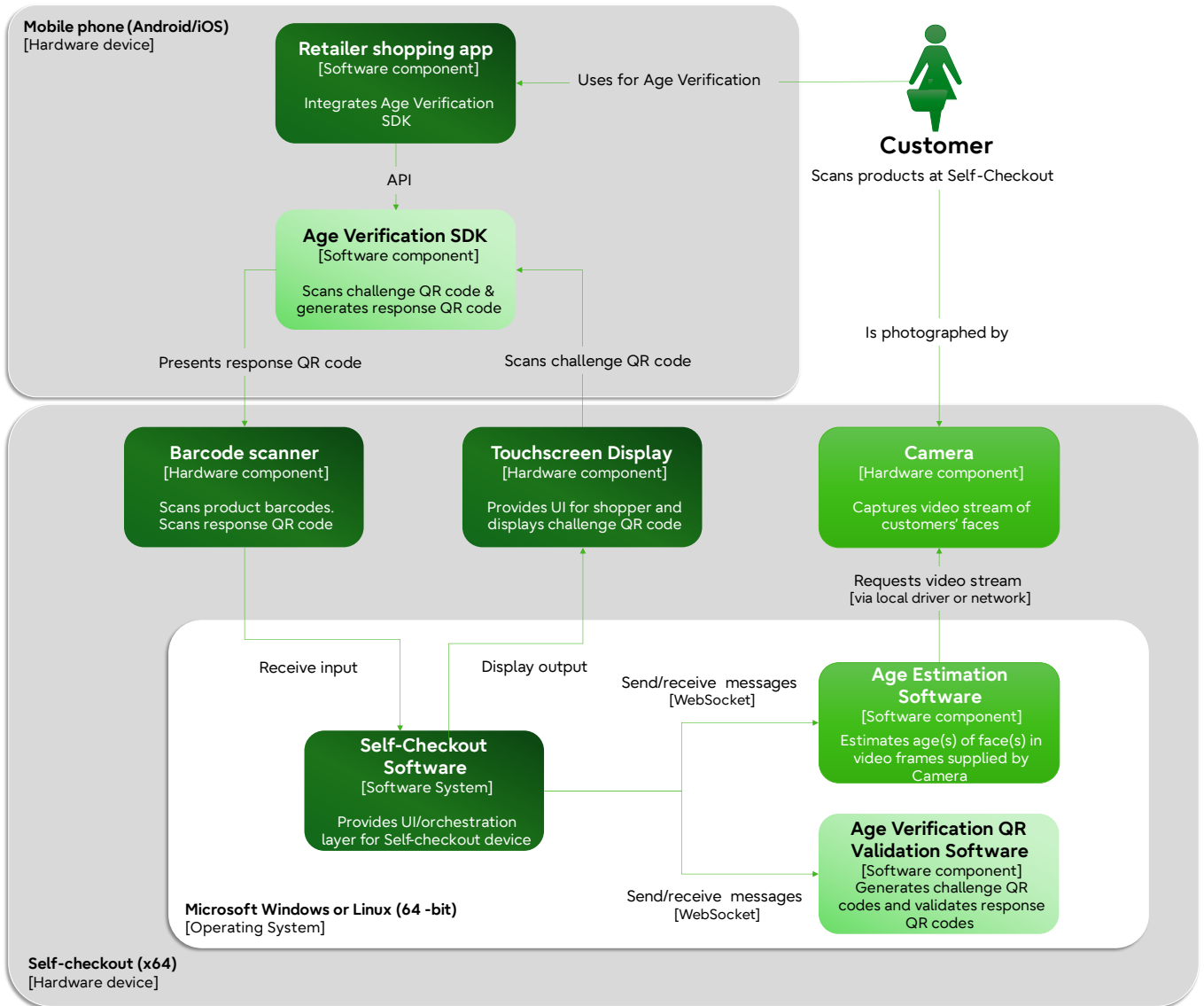**Self-checkout (x64)**
[Hardware device]

Existing Self-Checkout component

Age Estimation Component

Wider Age Assurance Solution for Retail

The context diagram below describes the different technical components and interactions for a complete implementation of Fujitsu's Age Estimation & Age Verification Solutions.

Configuration Options

Age Estimation for Retail has several configurable parameters set within the software's properties file. These options allow retailers to tailor the software to their specific requirements

Age Threshold: min_age	This is the age threshold to be met to pass Age Estimation such as "Challenge 25". If a customer is estimated to be below this age, then age verification will be required. Default: 25.0 Allowed values: Any positive decimal.
Minimum centre pose quality: min_center_pose_quality	Images where the face image is not sufficiently forward-facing toward the camera will be ignored Default: 0.3 Allowed values: 0.0 – 1.0
Minimum image sharpness: min_sharpness_quality	The required level of sharpness prior to estimating age. Prevents inaccurate age estimation due to dirty camera lens. Default: 0.45 Allowed values: 0.0 – 1.0
Minimum image contrast: min_contrast_quality	The required level of contrast prior to estimating age. Prevents inaccurate age estimation due to poor lighting conditions. Default: 0.45 Allowed values: 0.0 – 1.0
Minimum face height: min_face_search_size	Face images smaller than the specified size will be ignored. This helps to exclude customers in the background, who are not participating directly in the transaction, and young children Default: 150 Allowed values: Any positive integer
Liveness confidence: min_liveness	Tracked faces where this threshold is not exceeded will be excluded as spoof. Default: 0.7 Allowed values: 0.0 – 1.0

Installation Requirements

Operating System	Windows 8.1 (64-bit) or later. (Requires [Visual C++ redistributable](#))
	Linux builds tested and available for Ubuntu 22 and CentOS 7.5 (required package list available on request)
CPU	Intel® Core™ i3 (starting from 2nd gen Sandy Bridge) and above
Recommended RAM	4 GB or more
Average CPU utilization	< 10% average CPU utilisation for supported specifications
Minimum Camera Resolution	720p

Technical specification

Age Estimation accuracy	Mean Absolute Error (MAE) of 1.12 years for subjects aged 18–19-years-old
Gender/skin-tone bias	Negligible difference (MAE within 0.3 years for 18–19-year-olds)
Liveness accuracy	98% true-positive rate (at 1% false-positive rate)

Version Control

Date	Reason for update
16/11/2022	Initial publication
13/07/2023	Updated Operating System requirements and diagrams to describe Linux support
	Updated accuracy figures with latest test results
	Updated configuration options
05/09/2023	Updated sequence diagrams to clarify that age-check is typically at payment
	Changed language from "service" to "software" to clarify that we are providing local software rather than cloud-based SaaS software
	Added OS pre-requisites

Fujitsu

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