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MACHINE READABLE LINK EXPERIENCES USING SUPPLEMENTARY OBJECTS

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Machine readable link experiences using supplementary objects

Abstract

The core novelty presented here is to use deterministic machine readable links to locate additional supplementary machine readable objects. Leverages both deterministic and probabilistic links through a discovery based mechanism. Combines all the experiences to create a final experience for the user who is scanning.

Problem statement

- Machine readable links are either deterministic or probabilistic depending on the way that they are recognized.
    - Deterministic marks like bar codes have a unique ID associated with the mark. The system will recognize the unique ID and will provide the experience that has been pre-authored against that unique ID. Ex: A barcode containing the unique ID 34287 is shown a web experience www.samplepayoff.com.
    - Probabilistic marks use techniques like image recognition or OCR to identify objects and provide an experience that is associated with the object. Ex: If the scan recognizes an image of a dog, then provide the web experience www.petcare.com, and if the scan recognizes an image of a labrador, then provide the web experience www.petcare.com/labrador
- Each system on it's own is good enough for a limited number of use-cases. What's missing is a system where we could leverage both in order to deliver a precise experience.
- We propose a novel system where the system identifies a deterministic ID and uses the deterministic ID as an anchor to locate additional "supplementary objects". These supplementary objects could use probabilistic techniques like image recognition and optical character recognition(OCR) to deliver additional data towards delivering a precisely tailored experience to the user. We will also demonstrate how the novelty described here could be used for solving a real-world problem of authenticating cheques.

Solution

Our solution comprises of two novel flows:

1. An optional authoring tool for owners of the machine readable links. If authoring has not been done, the system will use heuristics/ML to identify supplementary objects and take subsequent actions.
2. Actions taken by the system on scanning of a machine readable link associated with supplementary objects.

Authoring tool

The authoring tool is used to explicitly specify supplementary objects with machine readable links. It consists of 3 steps:

1. Specify the deterministic ID.
    - Here, the author specifies the unique ID that will be used as a reference
    - This could be a URL or a unique code. Ex: A string that goes as a payload inside a QR code.
2. Specify the anchor point for locating supplementary objects
    - Typically, this could be the mark itself. Ex: In the case of a QR code, this could be the QR code itself that is used as a fiducial marker.
3. Specify how to locate the supplementary object.
    - This can be described by specifying distance from the anchor object using pixel dimensions
4. Specify how to decode the supplementary object
    - This is where the type of supplementary object is described. Some examples:
        i. An image that is identified using image recognition
        ii. A text string that is decoded using optical character recognition
5. Specify actions associated with the supplementary objects. Examples of actions could be:
    - Using the text string that is decoded from the supplementary object, call an API for validating the number.
    - Using the image that is decoded from the supplementary object, call an API for retrieving additional information.

Further along, we will use a specific use case of authenticating a cheque to describe the actions that can be used here.

System behavior

This section describes the system behavior(Refer to Fig 1) when a user scans a mark that has supplementary objects associated with it.
The key point to note here is that the final experience will use a combination of data obtained from the supplementary experiences(#01 and #02 in diagram)

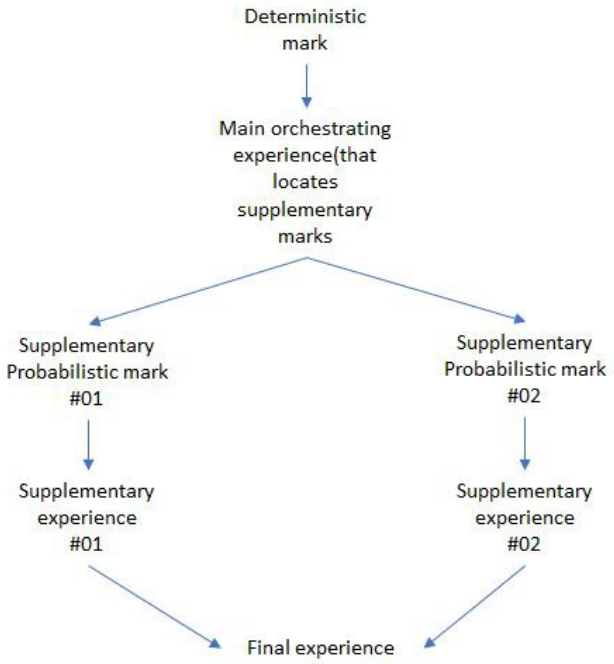

Fig 1: Association between primary and supplementary links

Reference use-case: Cheque validation using our approach

Cheque validation (Problem)

- After a Person A(issuer) issues a bank cheque to Person B(recipient), the recipient needs some way of validating the cheque. A lot of times, this validation needs to happen before the recipient has rendered a service for which the cheque is being issued. Current processes dictate that the cheque will be validated only after the cheque has been sent to the issuing bank.
- This has resulted in an increase in cheque frauds worldwide and caused inconvenience to both the cheque recipient and the bank service provider.
- Our mechanism proposes a solution (refer fig. 2) to validate whether the cheque is legible and bona fide by integrating digital marks(primary mark) with real-time image processing(supplementary marks) using mobile devices.

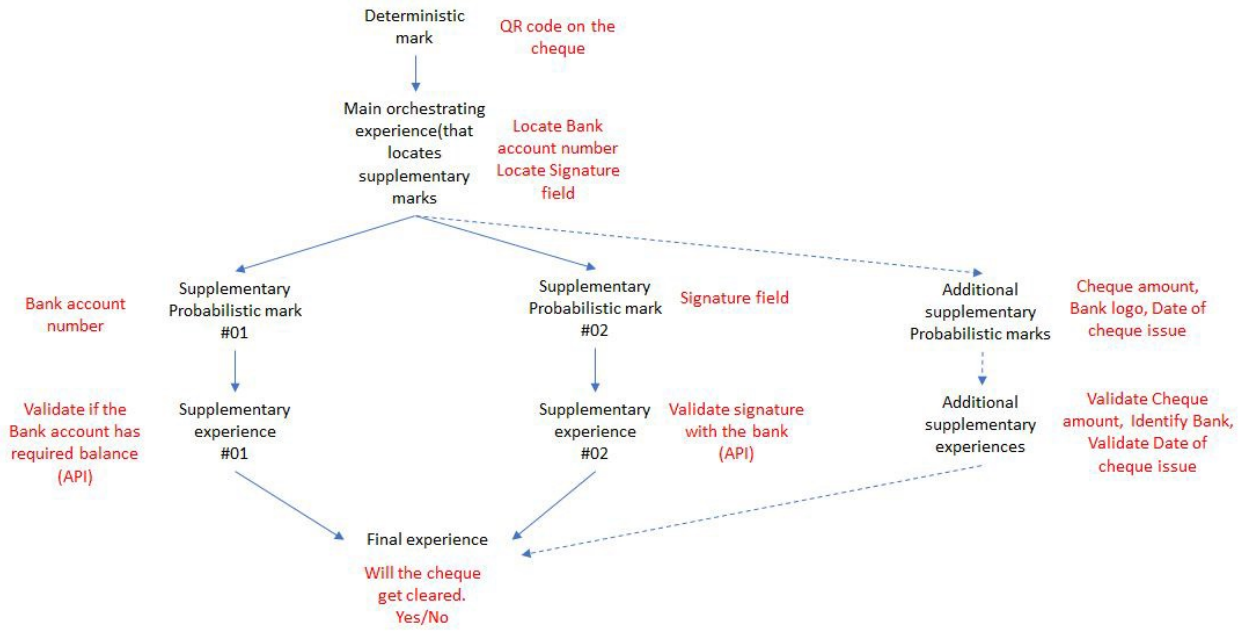

Fig 2: Association between primary and supplementary links for cheque validation use-case

Cheque validation (Solution)

Fig 3: Using our authoring solution to author cheques from Bank of China

- The paper proposes a solution where each cheque leaf will be embedded with a digital mark (ex: QR code) containing a unique identifier. The unique ID is pre-associated with information about the account holder on the cloud.
- The cheque recipient will use a mobile application to scan this mark. The application will detect the mark along with previously authored supplementary objects like cheque number, amount, date, recipient and signature on the cheque using image recognition. *(Refer to Fig 3 above)*
- Upon retrieving the account ID mapped to the mark, the application will connect to a validation engine*(Refer below to Fig4: System flow)* that communicates with the bank's server API using a secure gateway to validate the relevant information(viable balance and signature). Ex: Is the signature valid, Is the amount on the cheque available in the account, Is the cheque itself valid(validate the logo image)
- After validation, the response will be returned conveying the validity of the cheque.
- This way, the cheque recipient will be able to validate the authenticity of the cheque at the time of accepting it, without having to visit the bank.

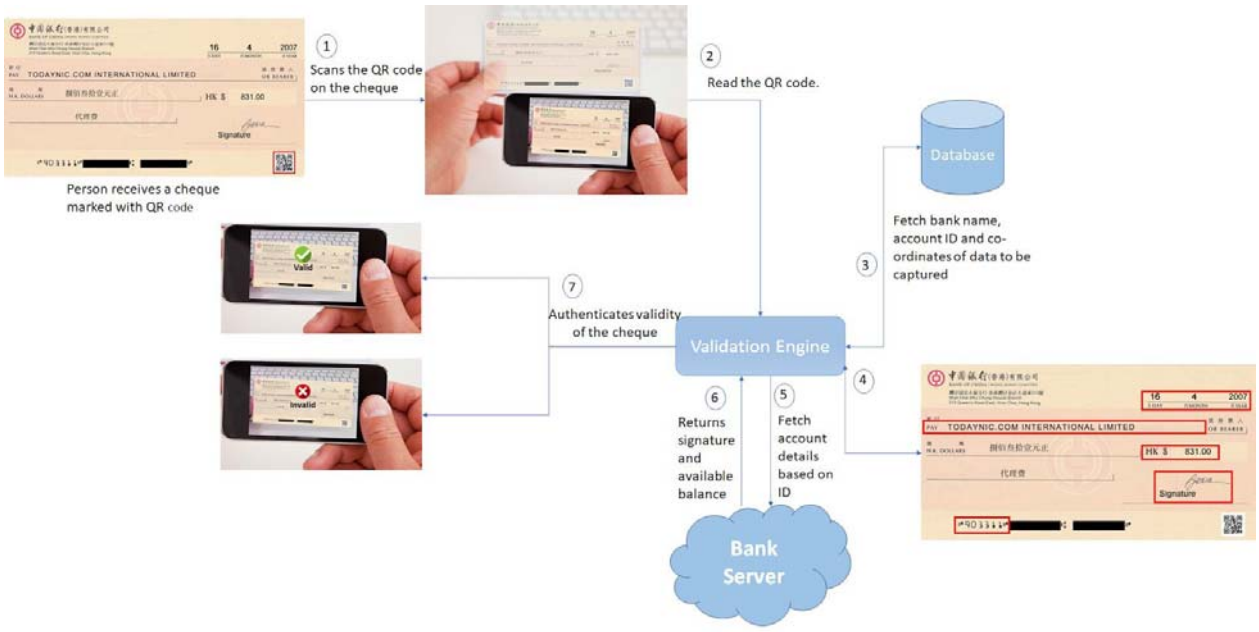

Fig 4: System flow for cheque validation

Shown below(Refer Fig 5) is an example of how a supplementary object could be authored and interpreted.

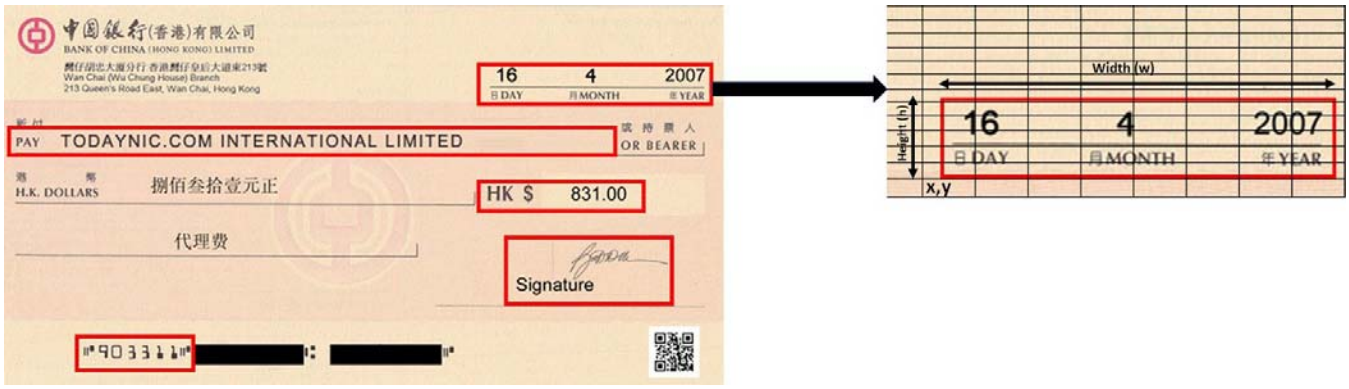

Fig 5: Interpreting a supplementary object (Cheque issue date)

Discovering supplementary objects from an anchor point

- The author will define multiple boundary boxes inside the image where the mark is to be embedded.
- This boundary box is defined as the position of the object to be detected if the image is considered to be lying on 2-D plane starting at (0,0) position.
- The boundary box takes x & y coordinates signifying the placement of said object with respect to the image starting position.
- It also requires extra attributes to create a virtual shape or a form which absorbs the said object. The attribute could be height and width, radius, etc. depending on the shape the author considers would fully consume the object.

Extension

- Authoring is optional. In case there is no authoring available, the system will use standard machine learning techniques to identify fields like Cheque amount, Account number, Cheque date etc and validate these.
- Alternatively, there could a constantly improving system where the initial seed data is from authored experiences and subsequent experiences are identified based on the Machine learning seed data generated by resolving the authored experiences.
- In addition to a specific use-case like cheque validation, this novelty could be applied to other use-cases like in-store consumer experiences on scanning a product package. Here, we would identify multiple supplementary objects(with or without prior authoring) on the product package(Ex: expiry date, allergy information, nutritional information etc.) to provide a final experience to the consumer.

Prior art

Smart cheques

- An existing solution for this problem would be “SMART Cheque”(http://www.amricon.com/smart-cheque.php) which provides the ability to validate the cheque details using RFID chips. For this solution, every customer will require Amricon Verifier.
- In contrast, our solution implements a dynamic marking technique that will work with standard bar codes and smart mobile devices. Smart cheques are more expensive, requires specialized devices and thus is limited to only B2B model.
- Additionally, our solution’s novelty is in creating an experience using discovered supplementary marks.

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