



PaymentBox

Take Control of your payments

October 2018

PaymentBox
<https://paymentbox.io>

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Problem

Today, most retailers accept major credit cards as a pay-in payment method. With the rise of cryptocurrencies, some have expanded to accept cryptocurrencies for transactions; however, most do not. It can be a large investment for a merchants to accept new payment methods as it would require finding a provider and processor, and then integrating it all into their accounting systems. Furthermore, many retailers also rely on fraud systems to catch fraudsters at the POS (Point-of-Sale). Due to the heavy investment and with cryptocurrencies not having wide adoption, most merchant stick to the traditional payment systems. This impacts those who are early adopters of cryptocurrencies and who want to see the adoption grow through real-life use cases.

Additionally, it's difficult to pay for another individuals' purchases without giving up your own financial information, or having to be physically present to complete the transaction. Consider the following scenarios: there are increasing trend of shopping online among teenagers in the USA. In order for teens to shop online, their parents share their credit or debit card information. However, parents may not feel safe sharing credit card information with their children because they cannot control their spending or verify their purchases. In order to control their spending and verify their purchases online or in-store, the parent needs to be present. This process is cumbersome and adds more friction in the shopping experience.

Solution

PaymentBox introduces a novel solution to help bridge the gap between consumers and merchants leveraging cryptocurrencies. PaymentBox mission is to make the adoption of cryptocurrency seamless for merchants, and also provide an avenue for consumers to use cryptocurrencies for their day to day transactions.

The the PaymentBox solution and it's delegation model makes cryptocurrencies more accessible and available at local physical stores without requiring any changes to merchants infrastructure. The challenges PaymentBox face are around volatility of the cryptocurrencies, exchanges, and time to process transactions.

The PaymentBox infrastructure competes directly with the traditional credit card/debit card issuers. Initially prototype is being created using Stripe. This document doesn't talk about how credit part of the card would work; but it would leverage similar structure as debit except the credit would be based on wallet history, balance, risks, etc.

This technology opens many possibilities to change the shopping experience:

- Pay using crypto-currencies. PaymentBox bridges the gap between merchants and consumers who leverages cryptocurrencies. The solution focuses on the cryptocurrencies consumers leveraging PaymentBox to make their cryptocurrencies more accessible and available at local physical stores or online store without requiring any changes to the merchants infrastructure. BlockChain and cryptocurrency backed PaymentBox network ensures that every transaction between the customers, merchants, PaymentBox services, and the payment processor is verified to ensure security, accountability, and convenience. The challenges PaymentBox faces are around volatility of the cryptocurrencies, exchanges, and time to process transactions.

· Authorize a secure payment for someone else and allowing them to use your credit/debit card or cryptocurrencies without revealing your financial information (Payment Delegation). For example, a parent can pay for their teenager's online purchase of pair of jeans without sharing their personal credit card or being present during the transaction. With PaymentBox, a freshman in college can shop online for books and initiate the payment by delegating the payment to his/her parents. Parents can then review the shopping cart and approve the transaction. No need to give a credit card number to anyone. Payment delegation also makes payments overseas easier. Imaging a parent paying for their teenager's living expense at another country.

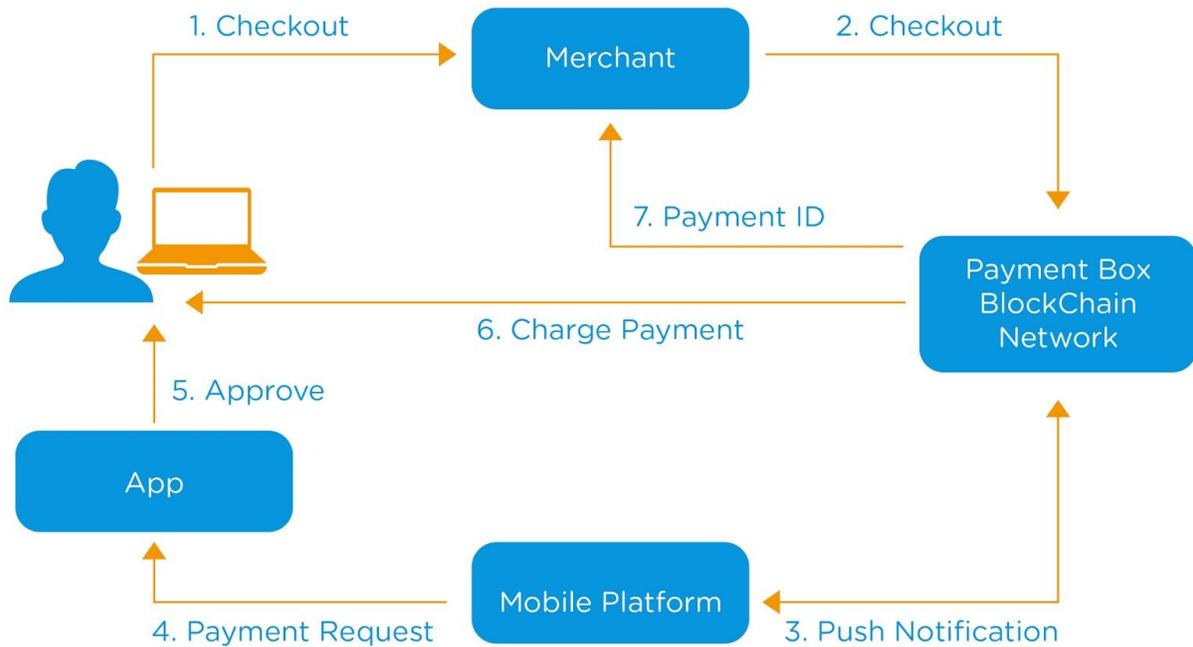
Technology

PaymentBox Transaction Flow

PaymentBox uses many different technologies to provide a secure and convenient method for online payment transactions. The following illustrates paying for a purchase using the PaymentBox network; it is not necessary to share financial information with the seller or PaymentBox.

1. User initiates the checkout process
2. The seller sends a payment request to the PaymentBox network
3. PaymentBox records the transaction in a ledger and then sends the payment request to customer's mobile device.
4. The PaymentBox mobile application receives the payment request.
5. The customer confirms the purchase and approves the payment request.

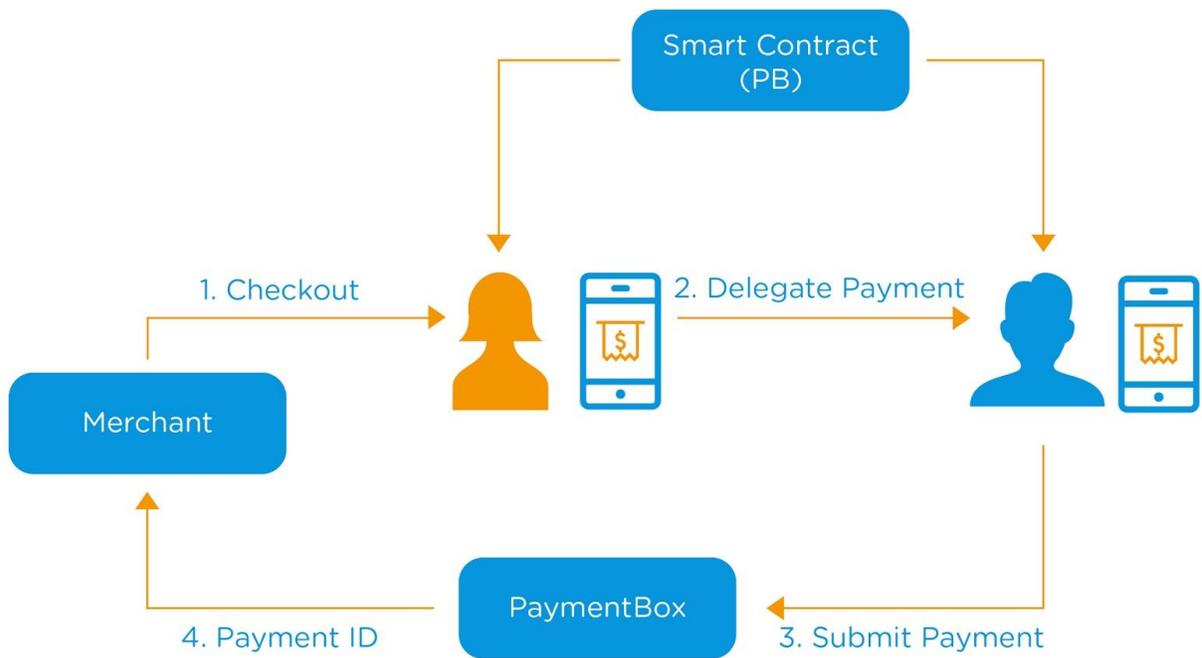
6. The payment is processed and the ledger is updated with the payment complete entry.
7. A payment ID is sent to the seller and the transaction is completed



When a customer pays for their shopping cart using PaymentBox, a payment request is sent to the PaymentBox server from the merchant. PaymentBox sends the transaction notification to the customer's phone for approval. If the customer decides to pay for the transaction directly, any mobile device specific payment option (such as ApplePay, AndroidPay, or SamsungPay) or crypto-currencies can be used to complete the transaction. No customer financial information is shared with either PaymentBox or the merchant during the payment process.

Payment Delegation

If a customer decided to delegate the payment request to someone else, PaymentBox provides an option to select a someone from their PaymentBox network or a phone number. Once selected, PaymentBox sends the transaction request to the appropriate person. A smart contract is created and the transaction is recorded in the ledger to ensure accuracy and accountability. No foreign transaction is needed when we combined the payment delegation and cryptocurrency payment.



CryptoCurrency Payment

For the PaymentBox debit/credit card, users would have to register/link their current wallet with PaymentBox. This deep linking allows paymentBox to debit/credit to these accounts based on usage. For credit cards, the limit might be based on risk model based on transaction history, length of account, other info.

Once a user is registered, PaymentBox would be sending the physical card to the approved user, but a virtual card would be available right away.

User can use these cards right away, and any authorization would be based on credit or debit limit sets. This is where delegation platform could be leveraged to provide another layer of specific limits/security.

Following are the key modules of PaymentBox:

PaymentBox Accounts

1. PaymentBox Wallet: PaymentBox wallet is where crypto currencies from user/consumer gets transferred when user uses a card
2. PaymentBox Stable Coin: This account is backed by PaymentBox wallet.
3. PaymentBox USD Bank Account: This account is leveraged by Stripe to fulfill the authorize transactions.

Registration

User signs up using their name, and address. User can send crypto currencies to the account/wallet generated by PaymentBox or link their personal wallet with PaymentBox. PaymentBox issues a physical/virtual card at the same time for user to use. The limit is based on asset linked to the PaymentBox account.

Issuer

Once the registration successful the user accounts with specific guarantees are linked actual PaymentBox USD account. PaymentBox acts as the bank here to authorize the transaction.

Payment Processing (Debit, Refunds, etc)

When user/consumer pays at a merchant using the provided physical/virtual card; PaymentBox gets an authorization request from the acquiring institution leveraging the Card Network. At this point, based on risk models PaymentBox would approve or decline the request (this also take delegated approver into account). If approved, PaymentBox makes a request to transfer funds from the consumer's or delegated approver's wallet to PaymentBox wallet. At this point, based on trading model either the crypto currencies are converted directly into some stable coin or placed in hold in PaymentBox account. The acquiring institution is reconciled by PaymentBox using Paymentbox account with currency of the merchant. This does bring some complexities but in general the process stays same for most transactions. One of the common occurrence would be of refund, where user might not get same amount of cryptocurrencies back because of volatility. Leveraging stable coins would reduce the risk for PaymentBox but the point in time when to convert the cryptocurrencies into stable coin would be very critical to the business and will have direct effect on different types of transactions (refunds, partial refunds, voiding a transaction, etc.).

Monthly reconciliation (Bill)

Volatility of the currencies impacts the kind of solutions PaymentBox can offer to its consumers. Leveraging traditional credit card model would, but having the payment directly debited using the wallet would be very much useful. Leveraging hold patterns on the account might help reducing the risk, while keeping the quality of service high.

General reconciliation (Internal)

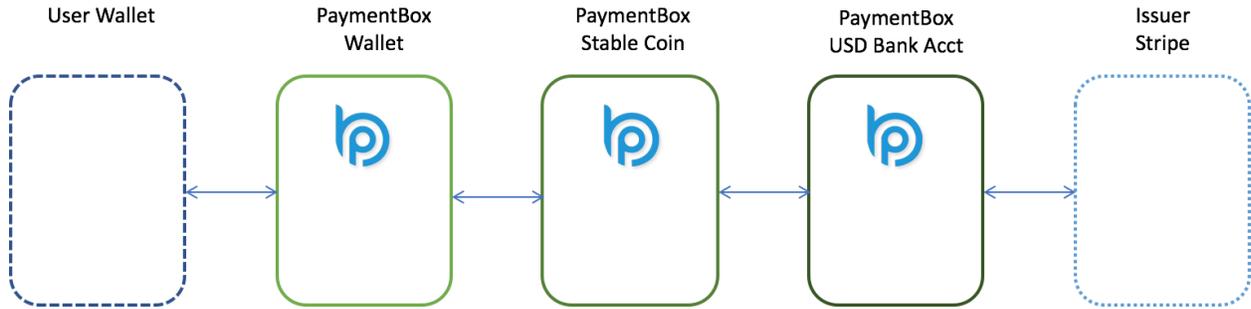
Given multiple accounts involved, PaymentBox would have to reconcile between users wallet, PaymentBox account, Stable coin, and actual transactions. This could get complex as the volume increases.

Quality of Service

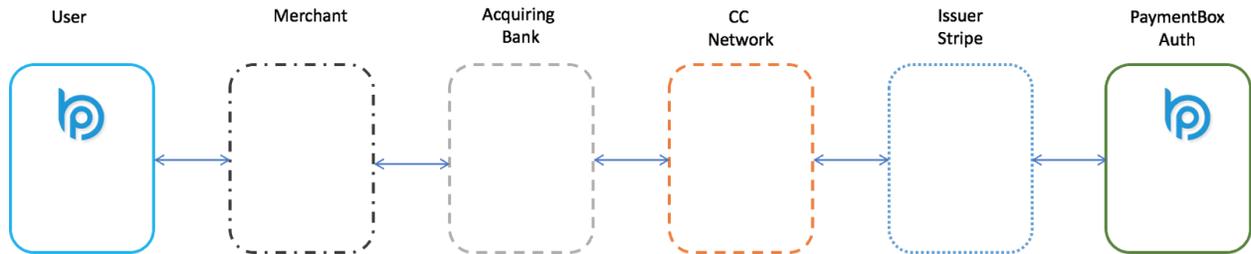
To meet required SLA, there might be risks PaymentBox has to take on certain transactions,, as they might not complete in time when transferring cryptocurrencies between accounts. There are few risk models that could be leveraged here. Another risk which PaymentBox has to mitigate is with payments at brick and mortar stores, when chain delegation is involved. This would slow the process of disbursement, as the requests would be queue to the downstream user/approver for approval with a hold on primary user's account (i.e. first delegator), while the request is delegated to further delegates. If other delegates approve the request then transaction is charged accordingly; with delegates wallet getting charged for the approved amount. If not, then first delegator is held liable.

Reference Diagram

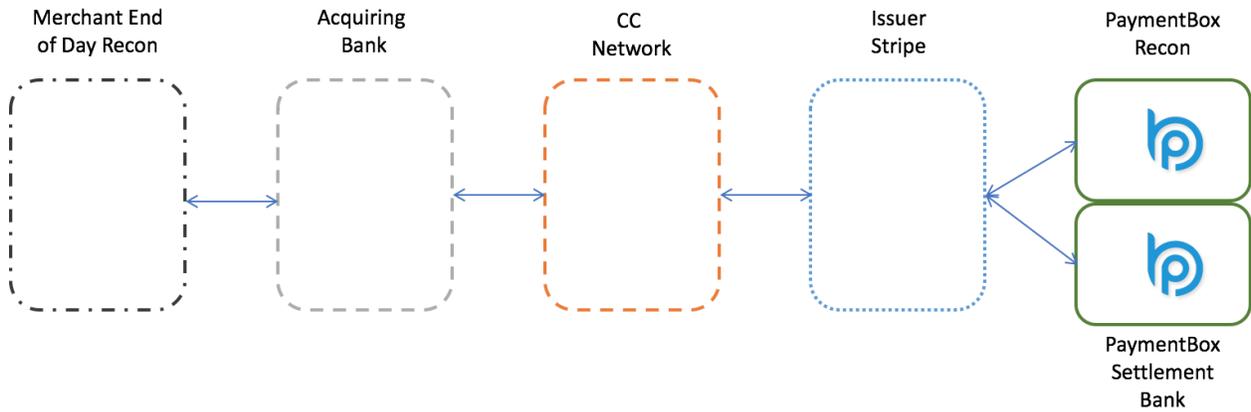
PaymentBox Infrastructure



Transaction Flow



End of Day Reconciliation



Risk/Fraud Detection

Risk and fraud Detection are at core of PaymentBox technology. To achieve a holistic approach to detecting security risks and fraud, we have created a multi-tier fraud detection system using advanced analytics, information services based on consumer/seller information and scores, and digital security software.

Fraud detection is a complex problem[2] and our solution is a hybrid approach. Our system detects fraud using certain data points (merchant general transaction range, source origination, vpn, date, time, and so on) and generates a fraud risk score for each transaction. The transaction fraud risk score (TFRS) in conjunction with the merchant fraud risk score (MFRS) is used by our rules engine to determine whether to approve, reject, or tag the transaction for manual review. Each manual review is tagged as dataset to maturing the TFRS algorithm.

The hybrid approach allows PaymentBox achieve a better balance of convenience and security by converting legitimate visits into sales while simultaneously identifying fraudulent transactions. Fraudulent transactions affect everyone from merchants, issuers, acquirers, processors, and even the service providers. "For every \$1 of fraud, businesses incur on average \$2.66 or roughly two and a half times the actual loss itself." [4].

Fraud detection becomes more difficult when information is hacked on a large scale (i.e Equifax) because a fraudster can leverage information from the breach to perpetrate multiple forms of frauds such as identity theft, re-shipping scams, account takeover, and clean fraud. Even with PaymentBox's risk/fraud analysis application; the two of the key feature which makes PaymentBox secure is that most of the transaction only happen after biometric validation, and PaymentBox leverages OS level security to ensure that only required information is shared to even PaymentBox.

Lastly, PaymentBox given payment commitment to open standards; PaymentBox is in process of joining FIDO Alliance (<https://fidoalliance.org>). This will not only help us provide better security for our service, but also gives us an opportunity to participate with other players in the larger ecosystem.

Machine Learning Integration

Integration of machine learning technology into business workflows and operations is becoming an increasingly important and technically feasible capability that every business should integrate. When applied appropriately, these technologies can accelerate product delivery, automate activities workflow and facilitate operating at scale. These features lead to decreased operational costs, improved up-time and better customer engagement.

At PaymentBox machine learning will play a critical role in our business operations. Specifically these include:

1. User and Merchant Reputation Models
2. Fraud Monitoring
3. Payment Share Modeling
4. Auto-Whitelisting of Products and Services
5. Decision Bias Monitoring
6. Customer Support Chatbot

Machine Learning Technology

There exist many Machine Learning (ML) methods that can be applied to solve an array of business problems. Selection of technology for PaymentBox will be focused around sample efficiency and robust decision capabilities. Our initial models will recruit a proprietary Reinforcement Learning (RL) algorithm that integrates numerous state-of-the-art technologies.

Modeled using the latest cognitive neuroscience research, our agent technology includes the following features:

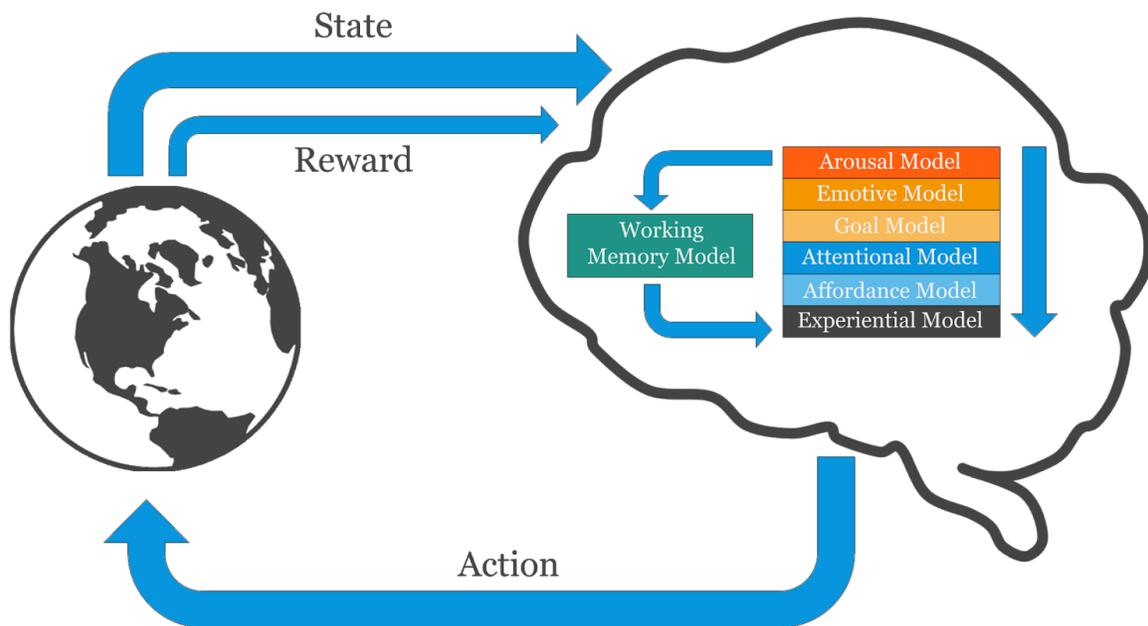
1. Uses 98% less training data than standard RL deep learning methods
2. Model auto-tuning supporting non-stationary environments
3. Continual skill learning

In addition to the innovative agent base model, the agent is architected to support a top-down recursively optimized decision making hierarchy. It is composed of the following models:

1. Arousal
2. Emotive
3. Attentional
4. Affordance
5. Experiential

The affective reasoning capability is comprised by the Arousal and Emotive models and has been found to be critical to human cognition (Damasio 1990). The primary role of affect or emotions in decision making is to guide strategy selection and thus significantly reduce the state and action spaces the agent must reason on. When integrated with the child models such as Goal, Attentional, Affordance and Experiential models (Figure 1) the agent becomes a holistic decision making model supporting both a bottom-up and top-down integrated system. This integrated model additionally includes a Working Memory Model (WMM) which is a generalized version Baddely’s Working Memory model that is used to modulate behavior through an imagination like capability. Imagination in the agent is implemented by managing experience replay, saliency modification and behavior priming. Experience replay in the agent includes the ability to revisit prior experience (both recent and long term) and testing different strategies and attend to different features from prior states. In this flow the agent can construct new intrinsically generated behaviors and value functions that are be used for future behavior. In this way the WMM is able to generate novel behavior and skills while building a so called ‘Common Sense’ model of the world that the agent can recruit to handle novel stimulus. When interacting with the world, the agent using the WMM will seamlessly transition between exogenous and endogenous stimulus while interacting with the world improving overall decision quality while minimizing computational resources needed by the agent.

Agent Architecture



Fraud Monitoring

Fraud detection represents a core component of any financial transaction history and is typically composed of a highly imbalanced dataset where fraud typically represents less than 1% of transactions. Because of this, feature engineering represents the most important task when building a fraud detection model. PaymentBox fraud detector using its cognitive agent architecture will be able to build detectors that automatically select features on a user and population basis automatically. As fraud methods change, the agent technology will automatically adapt and learn new patterns of behavior to detect fraud while reducing time to adapt by orders of magnitude from current practices.

Auto-Whitelisting of Products and Services

The PaymentBox product whitelisting feature enables users to mark specific products and services as not requiring delegated verification. An optional feature, administrators can enable and configure the auto-whitelisting agent to use the approval and denial history of products and services to automatically approve items on behalf of the delegating manager. Track through the existing ledger system, all transactions remain highly traceable should questions arise. This feature provides the delegator the flexibility to automatically update transaction whitelist, while maintaining control over products and services deemed to need active control. Ideal for companies, the auto-whitelisting feature saves managers time while providing the desired amount of control to ensure that employees appropriately spend.

Decision Bias Monitoring

ML based methods are increasing being deployed in systems that are now affecting millions of people everyday. From home loans, cancer diagnoses and employment, understanding the decisions that these algorithms make and ensuring that they are not biased against demographic groups due to human, imbalanced data or other mechanism is an emergent science. At PaymentBox, we take decision bias seriously and will deploy models that are focused on monitoring the decisions of our models throughout our ecosystem to ensure that they are minimizing the effect of bias. Pulling from academic research and methods of measuring bias within data, our Decision Bias models will act as our own internal watchdog to ensure that PaymentBox automated decisions are made for the right reason and with the right data.

Customer Support Chatbot

Providing quality customer support is one of the cornerstones of Paymentbox and to maintain higher quality care, the use sophisticated chatbots that can answer commonly asked questions will greatly reduce the labor requirements while allowing us to dedicate human resources to less common customer issues. For this capability, we are presently investigating the use of off-the-shelf APIs such as Google Dialogflow and Amazon Lex.