Restaurant Chatbot Business Model

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Step 1: Prototype Selection

Flo, the virtual waiter for Restaurants

Abstract

This paper formulates a method to update the menu and services provided by virtualizing the menu with added services. Virtual kiosks provide the means to view the menu to order items and complete payment at the convenience of the customer on their phones. The proposed system seeks to implement chatbots into these virtual kiosks with the added functionality to order items with ease, provide status reports on placed orders and answer FAQs. This can reduce the manpower required to manage the restaurants, reducing traffic and focusing attention to more important tasks.

Keywords: Chatbot*,* Virtual Kiosk

a. **Feasibility**: The general framework can be developed in less than 6 months. The specific model can range anywhere from 2 - 6 months depending on the needs of the consumer.

b**. Viability**: This product is the next step to incorporating a fully automated restaurant. It is highly possible to see such a model in every restaurant as the next standard.

c. **Monetization**: The development and maintenance of the product and can be directly monetized. A detailed overview will be provided in the business model.

1．Problem Statement

Let's consider something as simple as the menu. The menu is more complicated than meets the eye. There can be too many options on a menu which may feel overwhelming to a customer as well as add to the managerial cost of stocking on a lot of ingredients and vice versa. A large menu can be compensated by a waiter which recommends meals to customers but this recommendation can be biased. First impressions are crucial in the restaurant industry since it emphasizes customer service.

Receiving great reviews is wonderful, but whenever a negative review is made public, it puts off existing or potential visitors. Even if your food is excellent, your setting is distinctive and appealing, and your location is prime, if your service is poor, customers will remember. To conclude, the following problems are addressed:

- Overwhelming menu.
- Biased Recommendation.
- Wrong order placement.

- Impolite service.
- Delayed status update
- Less availability of waiters

2. Market/Customer/Business Need Assessment

The restaurant business is always very competitive. Restaurant owners must be aware of food trends and how they affect their menu, regular business operations, marketing, and other factors if they want to flourish. Juggling so many things can be quite challenging. To overcome this challenge and grow, restaurants like any other business must integrate the latest available technology. To keep up, owners and operators leverage modern technologies such as AI-powered restaurant chatbots to communicate with their customers.

3. Target Specifications and Characterization

The customer base covers customers who visit the restaurant for dine in or takeout, it can also be applied to customers who order online as future work. In store customers can use the virtual kiosk to place orders while online customers can use the website or the app. They can interact with the chatbot to get recommendations based on similar taste and status reports on placed orders, FAQs, etc

4. External Search

a. Challenges of Restaurant managers

b. The Use of Artificial Intelligence in the Restaurant Industry: Impact and Benefits

c. Restaurant Chatbots – Comparing 5 Current Applications

d. Conversational AI chatbot using Rasa NLU & Rasa Core

5. Bench marking alternate products

	Allset	Conversable	Guestfriend	Gupshup	Punchh, Inc.
Funds raised	$8.4 million	$6.85 million	$5 million	$44.1 million	$33.5 million
Year founded	2015	2014	2017	2005	2010
HQ location	San Francisco, CA	Austin, TX	New York, NY	San Francisco, CA	Mountain View, CA
Staff size	57	35	7	136	136
Target user	Restaurant owners and execs	Enterprises, business owners	Restaurant owners	Entrepreneurs, small businesses	Restaurant owners, CMOs, CDOs, CIOs
Types of data processed	Text	Text, voice	Text	Text	Text, voice

Allset claims to make the dining experience convenient and fast for users by allowing them to use either the Allset application or the Allset Bot to make reservations, order ahead, plus process payment and tip in advance of the guest(s) arrival at their chosen restaurant. The chatbot is activated by the user typing "Get Started" and "Order Now." The bot requests the zip code or street you'd like to search for restaurant options. After confirming the location, users scroll through restaurants, choose one, indicate their time of arrival and whether they'd like to order from the pre-selected options shown in the messaging app.

Conversable claims to be a SaaS platform for designing, building and distributing AI-enhanced messaging and "voice experiences" across multiple platforms, including Facebook Messenger, Twitter and SMS.

For example, TGI Friday's uses the Conversable platform to allow patrons to make reservations, browse the menu, place orders and search frequently asked questions.

Conversable seems to be an in-depth, intensely detailed application appropriate for those businesses who are looking to create personalized messaging and customizable communication flows, rather than those businesses that need a more standardized approach in integrating AI with customer service.

Guestfriend claims to build chatbots for small businesses using publicly available data, such as operating hours and a business' address, which is automatically sourced by the software. Their primary selling point is providing a "fully customized bot for any small business."

The Template Bot Builder, created by Gupshup, claims to provide entrepreneurs and small business owners with pre-defined templates using chatbots, connecting them to their target audiences and digitizing day-to-day functions.

Punchh, Inc. claims to be a fully integrated, transformative marketing solution for restaurants loyalty programs, its chatbot technology integrates into existing point-of-sale systems, loyalty and ordering programs and connects to customers via message and voice-based apps, like Facebook Messenger and Alexa.

6. Applicable Patents

RASA open source is free to use and distribute.

7. Applicable Constraints

RASA (machine learning framework used to create chatbots) offers free services where any developer can pick up and use their open source libraries as well as premium services for which they provide consultation and the best support. The cost to implement such a software comes down to the platform used, chatbot deployment and maintenance, services required, complexity. As such the price can range between 15,000$ to 30,000$.

8. Business Opportunity

Restaurants implementing self serve systems using virtual kiosks cut down on manpower cost. Unlike humans, machines do not make mistakes making them perfect for repetitive tasks. This means managerial expenses can be levied and attention can be diverted to more human tasked work like marketing, overall management, food quality checks, etc.

Nowadays we see big restaurant chains implementing self serve kiosks with big screens and comfortable interfaces. These interfaces may not be affordable for the smaller scale restaurants. Using the virtual Kiosks gives them the opportunity to benefit from high end kiosks for a fraction of the price.

9. Concept Generation

We have all seen or used self-serve systems like digital or virtual kiosks. These solutions have paved the way to a deeper integration of technology and AI. While initially they served the purpose of automating order selection and payment, now they can be used to assist with status updates, FAQs and recommendations.

These technologies have yet to be implemented in establishments that interact with a large customer base physically.

There is no denying that loyal customers develop a relationship with the restaurant through a worker. This appears to be the deepest issue in implementing new technologies in small/medium sized businesses where the connection to the establishment may be broken in an attempt to cut costs and raise profits.

10. Concept Development

The chatbot serves functions of order taking, order manipulation, food recommendations, order placement and status updates. This chatbot can be integrated into any platform like a website, messaging applications like messenger, whatsapp, etc. Customers dining at the restaurant can scan a QR code which redirects them to a platform to start a conversation with the chatbot. They can view the menu to place and edit orders. Once confirmed, they have the option to request for time left. Payment is not handled by the chatbot itself. The cashier will have access to the database containing placed orders to conveniently bill the customer once they choose to leave.

11. Final Product Prototype (abstract) with Schematic Diagram
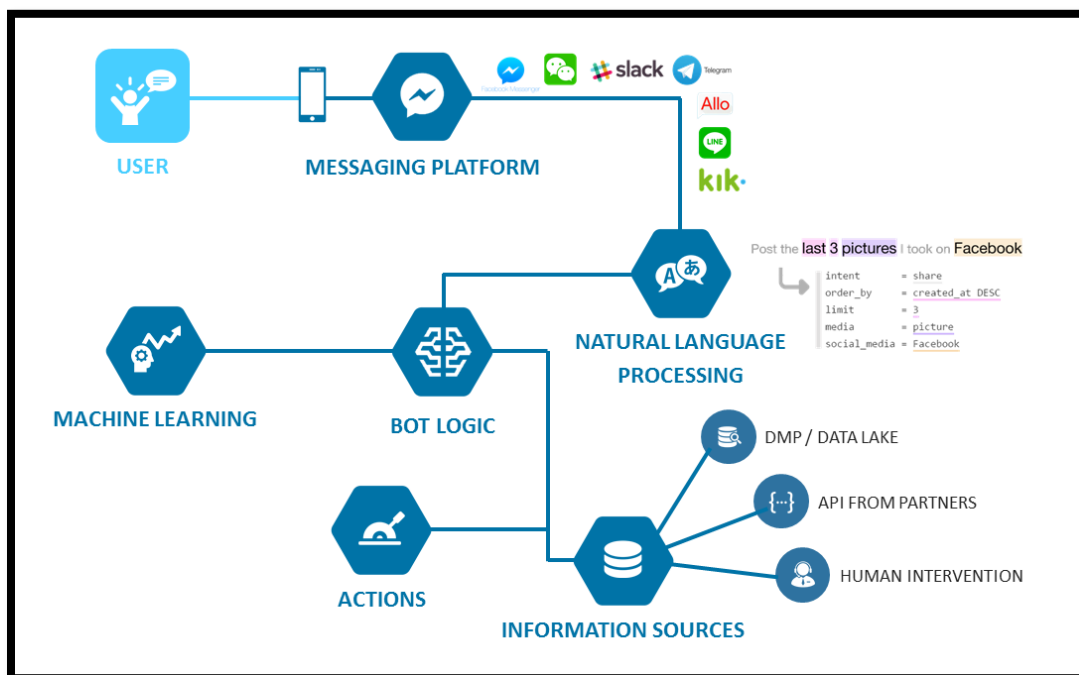
The above schematic shows the overall working of a chatbot. Unstructured text is received from the user which is processed to gain semantic value of the text. This text is processed by the bot to understand the intent of the user.

The user intent and actions performed are done as per the stories created for the bot to comprehend. RASA provides an excellent framework to work on chatbots with added flexibility.

It is an open source library that can easily be integrated with any platform. The information processed by the chatbot and the information passed out are stored and accessed from a database. This database contains item information which is used to confirm their availability as requested by the user.

12. Product details

The chatbot is built using the RASA framework. RASA provides flexible conversational AI for building text and voice-based assistants. Used by developers, conversational teams, and enterprises.

1. **Rasa NLU:** It is used to perform NLU tasks like intent classification and entity recognition on the user queries. So, basically its job is to interpret messages.
2. **Rasa Core:** Rasa core is used to design the conversation. It handles the conversation flow, utterances, and actions based on the previous set of user inputs.

The Rasa core and Rasa NLU are open source python libraries for creating conversational software. Their purpose is to make machine-learning based dialogue management and language understanding accessible to non-specialist software developers.

The main component of the model is a recurrent neural network (an LSTM), which maps from raw dialog history directly to a distribution over system actions. The LSTM automatically infers a representation of dialog history, which relieves the system developer of much of the manual feature engineering of dialog state.

Rasa NLU is a kind of natural language understanding module. It comprises loosely coupled modules combining a number of natural language processing and machine learning libraries in a consistent API. There are some predefined pipelines like spacy_sklearn, tensorflow_embedding, mitie, mitie_sklearn with sensible defaults which work well for most use cases.

Rasa Core predicts which action to take, from a predefined list. An action can be a simple utterance, i.e. sending a message to the user, or it can be an arbitrary function to execute. When an action is executed, it is passed a tracker instance, and so can make use of any relevant information collected over the history of the dialogue: slots, previous utterances, and the results of previous actions.
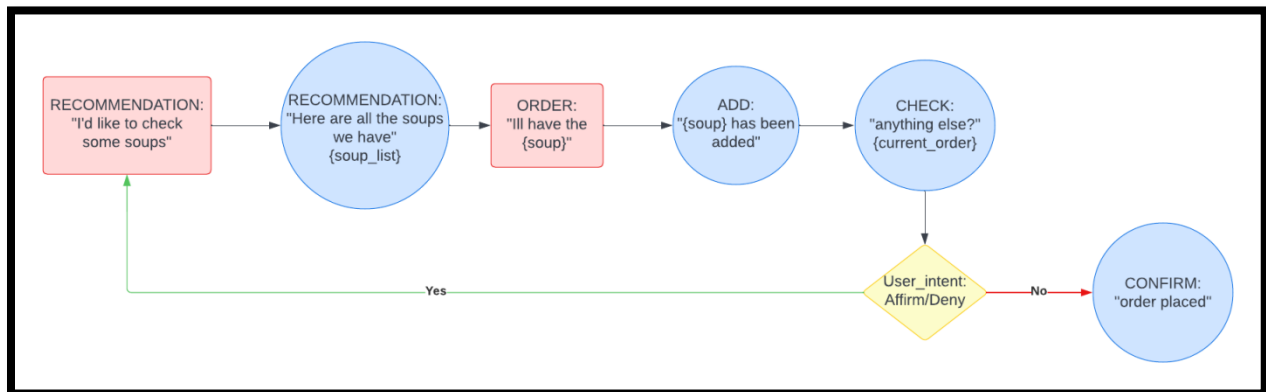
The following image shows that how the how the Rasa Core and Rasa NLU work together:
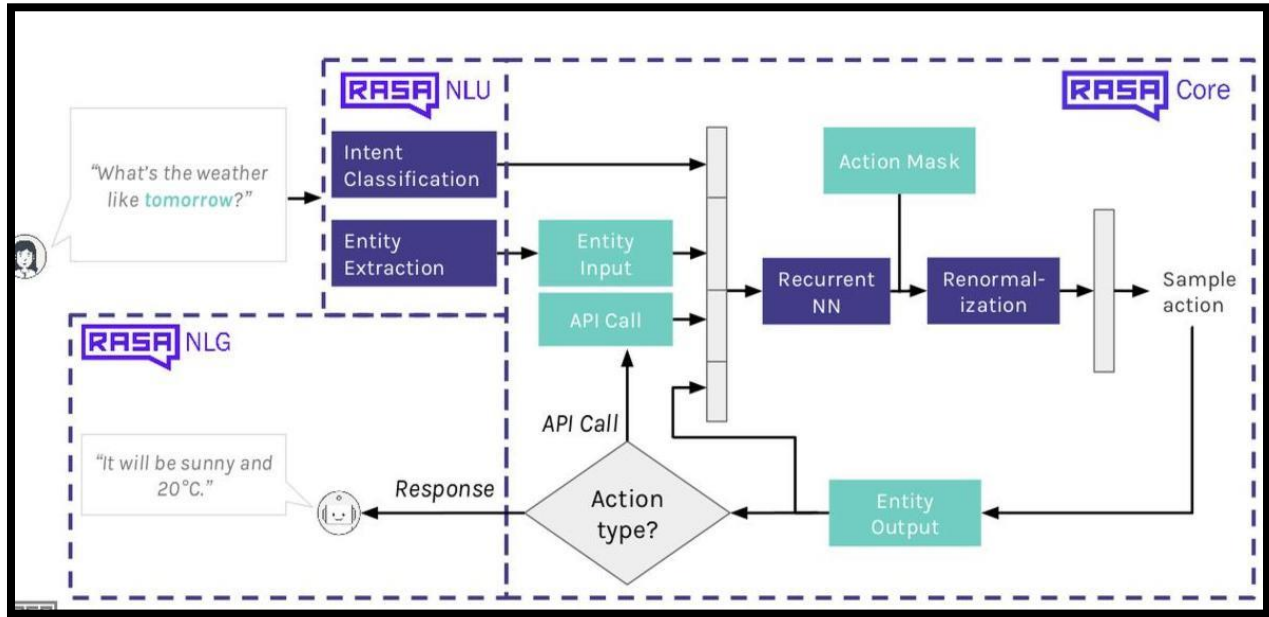
Below is a flow diagram that briefly explains the order taking flow in a conversation with a chatbot. This flow is not written in stone, the chatbot is built to flexibly handle deviations.
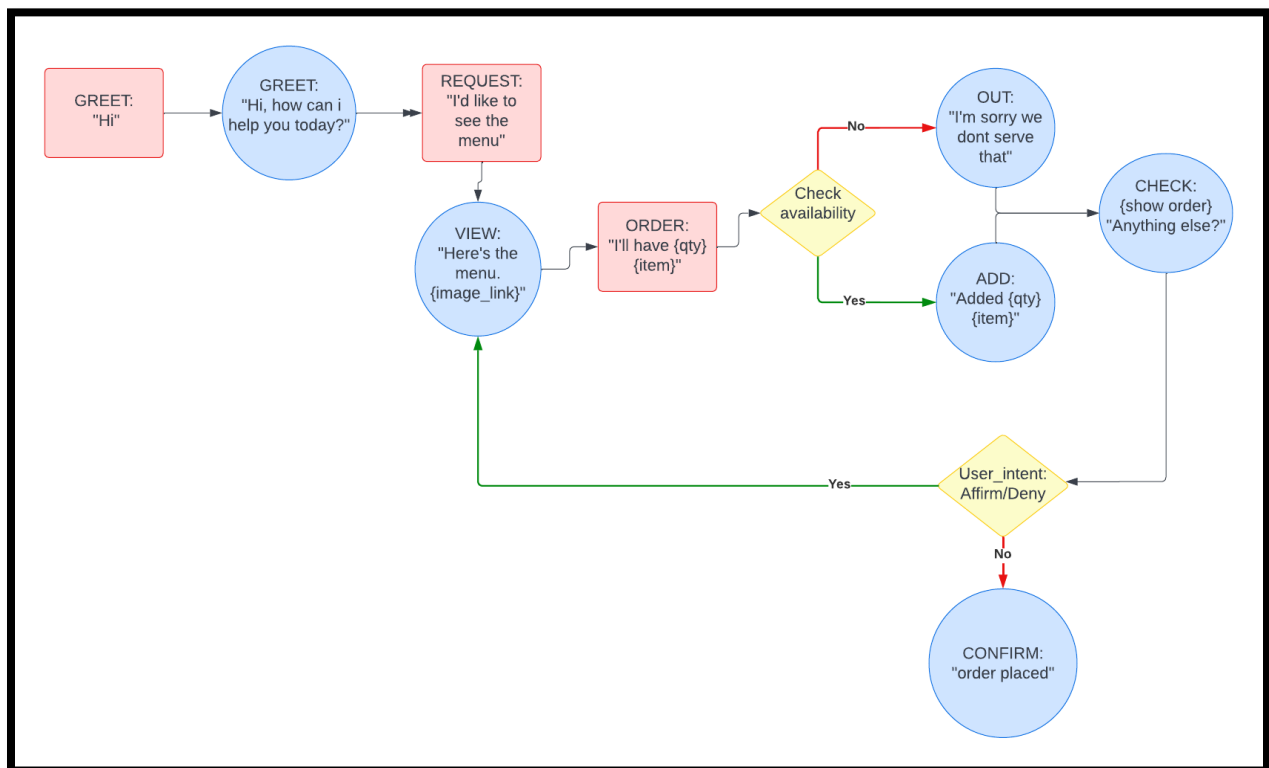
Similarly, the below flowchart depicts the working of the recommendation dialogue.

These flowcharts depict stories that help the chatbot guide the user to a satisfactory experience.

The user intent is highlighted in red and the chatbot's action in blue. Intents help the chatbot recognize the user's intention to which an action containing text or images is sent back. The response is recorded and the order is placed. The ordered items, quantity, and section they belong to, are received from the user during order creation. These are called entities, they are extracted from user text using pre-built models like Duckling Spacy and DIET classifier and saved in JSON format.
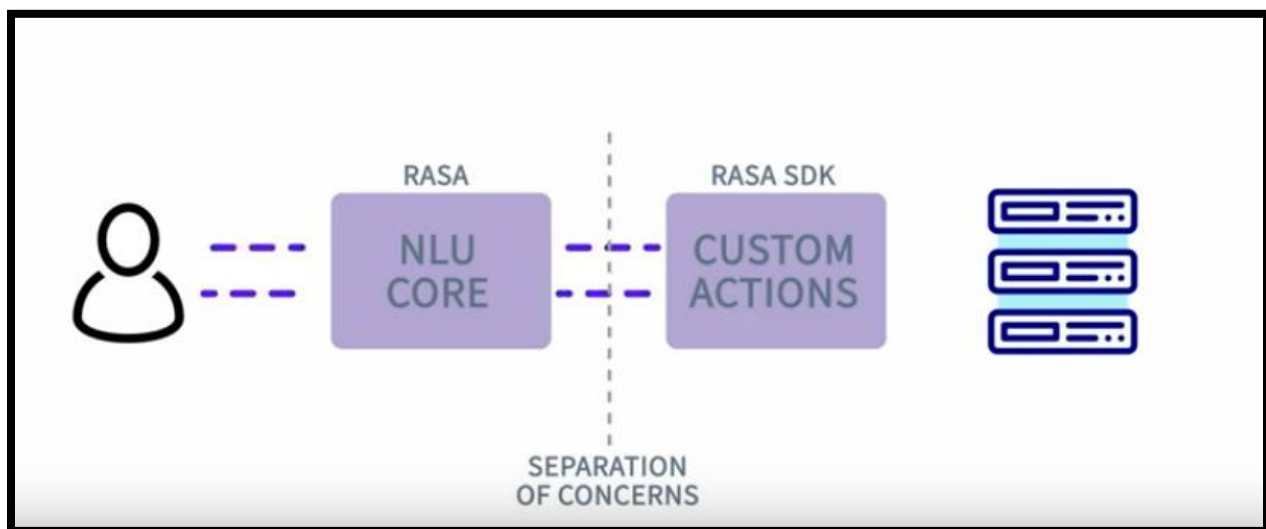
Custom actions as the name suggests allows the developer to create user-defined actions which have added functionality beyond the pre-built ones provided. This feature allows great flexibility in how the chatbot can be setup to pick up intents and act accordingly.

Step 2: Prototype Development

13. Code Implementation/Validation on Small Scale Simple EDA

Refer to the Github Link provided. Please go through the ReadMe to set up the required environment to train and interact with the bot.

https://github.com/Haseebae/Flo

The chatbot's functionality has been shown in the figure below. It demonstrates the basic features of the chatbot through the rasa shell. This model has been saved and can easily be deployed on any platform.

Operational Flow of the service:

The primary objective of the service is integration with the existing restaurant management system. The chatbot will be customized to cater to the restaurant's menu and give recommendations as specified by the customer.

It can be deployed on any platforms like whatsapp, facebook's messenger or even a custom website. This platform can be accessed by the restaurant's customers by a simple QR code situated on their table/ dining area.

Once the order has been confirmed, it is sent to the concerned team to carry out orders and create the bill.

The satisfied customer can then choose to pay the bill by requesting to talk to a waiter or on their way out, whichever is convenient for the restaurant.

14. Conclusion

Virtual kiosks implementing chatbots are the next step to tech integration at the small/medium scale businesses.These chatbots can handle basic queries about the establishment and help the customer reach a purchasing decision. The chatbot developed for the paper is a restaurant chatbot called "Flo". So far this chatbot is capable of simple tasks like viewing the menu, adding items to the menu, placing the order, providing recommendations, etc. Flo was created over a very small amount of time and has a long way to go before deployment. Chatbots created using RASA simplifies building chatbots in small/medium scale businesses like restaurants. One can choose to add better functionalities to their bot by including a team that maintains databases and fixes bugs.

```
Bot loaded. Type a message and press enter (use '/stop' to exit):
Your input ->  hi
Hey! May i take your order.
Your input ->  show me the menu
Here is the menu:
cheese pizza
meat pizza
veg biriyani
non veg biriyani
pepsi
tea
coffee
Your input ->  hmmm
Hey! May i take your order.
Your input ->  show me veg items
cheese pizza
veg biriyani
Your input ->  i will have a veg biriyani
veg biriyani is added to the menu
Anything else?
Your input ->  no
Your input ->  show me my order
Here is the order so far:
veg biriyani
Total is 300 rupees.
Shall i confirm?
Your input ->  no
Your input ->  show me drinks
pepsi
tea
coffee
Your input ->  add a pepsi
pepsi is added to the menu
Anything else?
Your input ->  view order
Here is the order so far:
veg biriyani
pepsi
Total is 340 rupees.
Shall i confirm?
Your input ->  yes
Your order has been placed.
```

This figure demonstrates the working of the chatbot. It does not resemble the final UI that customer interacts with.

Step 3: Business Modeling

The business model that best suits the idea presented above is the **_Razor Blade_** model. The chatbot service will be the initial premium service that is supported with a database, website which accumulates a small operational fee for a long duration of time.

Service description:

The Chatbot development is charged at a premium initial investment. This investment is used to create a chatbot that understand the menu and FAQ's relevant to the restaurant (Razor).

The supporting software like the cloud service that stores the menu, the website hosting the customer UI, come under operational costs which can be charged at a minimal price on a subscription basis (Blade). This price varies depending on the platform the user chooses.

There is also the option of adapting the restaurants approach through data collection and analysis which in turn increase the chances of success post chatbot integration.

To summarize, the service includes the chatbot, hosting on platforms; preferably websites which allows for a user friendly personal touch to the restaurant and data collection and analysis on the performance which can be used to customize the product mix.

Such a service involves a loyal relationship with the restaurant which results in a long term commitment.

Unique value proposition:

The existing competition in this field primarily concerns existing self serve systems. These include simple websites and self serve kiosks. The self serve kiosks are priced at a premium due to their large interfaces. The websites don't benefit fully from only having an online menu. The cons for both these models are met with the implementation of a chatbot which comes at a lower initial premium and benefits from operational costs by cutting down on manpower.

Target Market:

Restaurants implementing self serve systems using virtual kiosks cut down on manpower cost. Unlike humans, machines do not make mistakes making them perfect for repetitive tasks. This means managerial expenses can be levied and attention can be diverted to more human tasked work like marketing, overall management, food quality checks, etc.

Nowadays we see big restaurant chains implementing self-serve kiosks with big screens and comfortable interfaces. These interfaces may not be affordable for the smaller scale restaurants. Using the virtual Kiosks gives them the opportunity to benefit from high end kiosks for a fraction of the price.

Majority of the restaurants in India are not AI ready especially the small/ medium scale restaurants. *Flo* provides a means for them to digitalize and save on operational costs which gives them a huge edge over their competitors.

Small scale restaurants can also levy the regular subscription costs by opting for a cheaper platform such as WhatsApp, messenger, etc

Marketing strategy

The service is most likely to succeed in Tech ready states like Maharashtra, Telengana and Karnataka. Regardless, such a service can be a distinguishing factor for restaurants in less tech ready states where it then becomes an attraction but this theory has yet to be tested. The service can quickly pick up traction after successful implementation at a single outlet. Each outlets success with the service is expected to draw in successive restaurants.

Development costs

Development will range over three main things:

1. Creating and customizing the chatbot
2. Platform Deployment
3. Market segmentation

Creating and customizing the chatbot:

This requires the need for a member, proficient in NLU and RASA. Once the default framework has been set, the chatbot can be easily customized. RASA open source is free to use and distribute, it provides a very intuitive framework for chatbots.

Platform deployment:

The most premium option available would be to have a custom website for the restaurant. This would require a team member who is proficient in Front-End Development. Budget friendly options involve hosting the chatbot on messaging platforms.

Market segmentation:

This long term loyalty option is available as a result of the huge amount of data that can be acquired as a result of digitizing the whole customer experience. Valuable insights can be drawn from order preference, reviews, etc. This track is optional and falls under the premium services provided.

Step 4: Financial Modeling (equation) with Machine Learning & Data Analysis

Identifying the market:

The proposed service can be used in any type of restaurants, which is looking to maximize their productivity and at the same time wants to optimally utilize the resources at hand.

**Restaurant Sales Prediction:**

We couldn't find the appropriate dataset related to our prototype but have found and done the required analysis on a similar dataset which was found on kaggle.

Dataset : Restaurant Revenue Prediction

The code involves visualizations and techniques to work with the date time feature. Various regression models have been used and the one which gives lowest Root mean squared value is selected as the best model. Below is the link for the notebook

Github Link: https://github.com/BairagiSaurabh/Feynn-Labs-Task

Financial Equation:
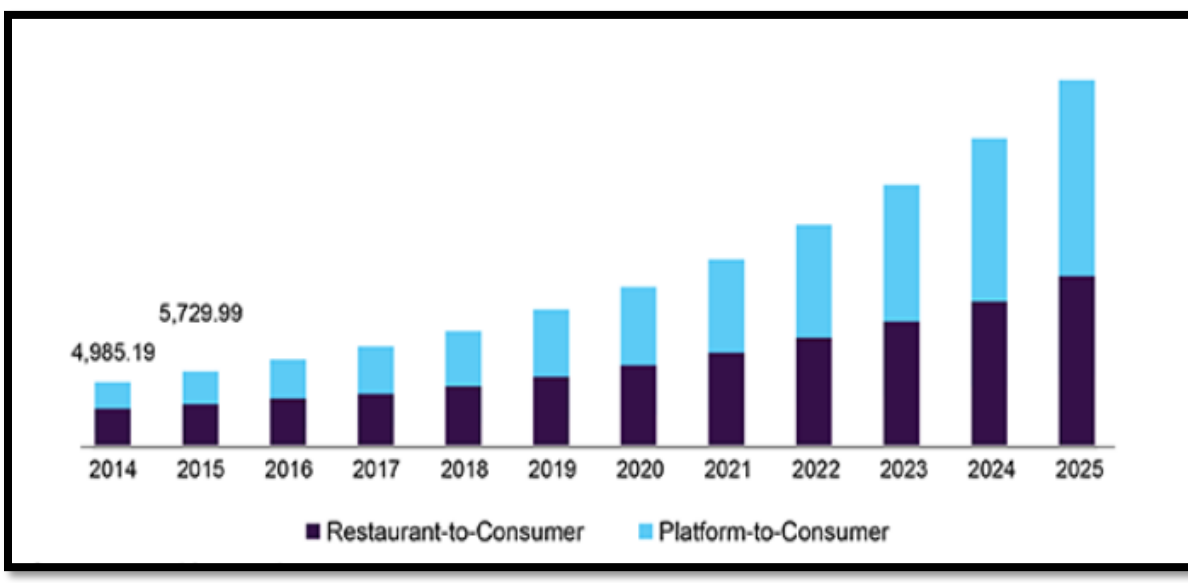
The above plot depicts an exponential growth where the (x-axis = Time) in terms of years and the (y-axis = Sales/ Revenue Generated) in thousands. It clearly indicates that with integration of AI, the restaurants can boost up their revenues. Below curve shows how the growth looks like for a span of a decade.
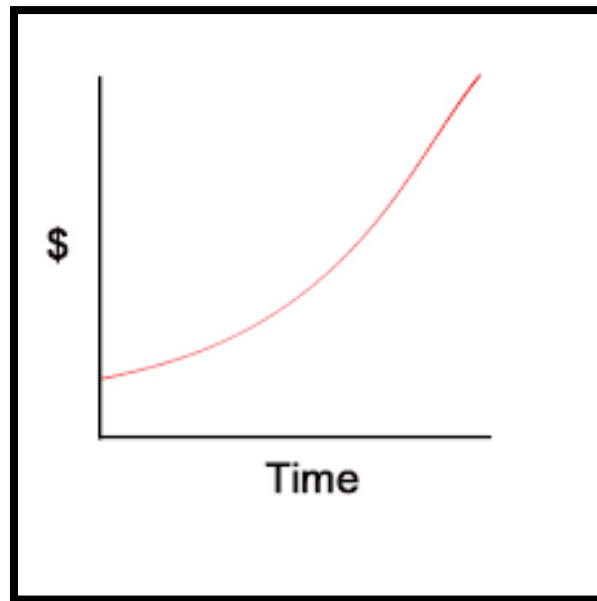
$$Y = X * (1+r)^t$$

Y = Profit over time, X = Price of our Product, r = growth rate, t = time interval

Depending on the needs of the customer, the chatbot itself can be priced at 1-3L/month. This price would cover both maintenance and development. This cost would exist until the chatbot has matured, so max 6 months, then depending on the deployment platform of choice, the price would be in the range 10k to 1L/month.

Conclusion:

Smaller restaurant conglomerates may view AI technology of this kind as superfluous given the small amount of hard data that accompanies these applications. We suspect that larger restaurant giants with existing tech infrastructure and high volumes of customer data are most likely to take advantage of these technologies in the near term.