Conversational User Interface

Team 4

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1. Executive Summary

1.1 GLOCO

GLOCO is a multinational medical equipment manufacturing company providing its products to clients around the globe. The company recorded net revenue of $7 billion dollars last year, making it one of the largest medical equipment manufacturers in the world today.

Currently, end customers interact with GLOCO systems using the GLOCO Consolidated Gateway that sits between users and business unit sub-systems such as product information pages, the CRM system, and order tracking tools. GLOCO’s vision is to enhance usability for all end customers of its systems.

1.2 ICT

We as GLOCO’s ICT (Information Technology and Communications) organization propose a new Conversational User Interface (CUI) system to empower end customers and facilitate the penetration of the end customer market segment. The system will have two broad interfaces: a chatbot style text interface as well as a voice recognition system. Both of these systems will feed the requests to a natural language processing (NLP) system for analysis. This system will interact with the GLOCO Consolidated Gateway API to reach each of the business unit sub-systems.

The CUI enabled application will significantly reduce complexity for end customers as they will have a single point of access. This in turn reduces the complexity of managing customer interaction for the staff. Overall cost of managing the different systems will also be reduced as there will be less reliance on service desk staff and more automation of customer requests. This allows IT processes to be more agile and improves service time.

The CUI interface will be integrated as an enhancement to the existing web and mobile applications. GLOCO ICT will integrate best of breed third-party technology to provide the CUI.

1.3 The Solution

We propose to develop a solution that provides the following high-level capabilities:

- A speech and chatbot enabled natural language interface
- Integration with GLOCO Consolidated Gateway API
• Ability to select products, place orders, and track shipments
• Collects and tracks customer usage trends and behavior
• Allows fast service support through the application chat functionality
• Notifies customers of new products and services from GLOCO
• Enables customers to receive alerts from their medical equipment. For example, a pump feeder can send alerts if the feeding formula has finished or if there is an error, directly to the registered user’s mobile application

The GLOCO CUI tool will improve the customer experience, reduce costs and maintain the company’s competitive advantage.

2. Business Requirements

2.1 Business Summary

Figure 1: GLOCO As-Is Diagram
The current As-Is interaction with GLOCO systems for end customers requires many steps and a high-level of user sophistication. All interaction requires that inputs be typed, whether using a physical keyboard and mouse or mobile touch input.

There are several steps involved that require users to directly interact with many systems in turn, in the proper order. Figure 1 shows the example of order placement. A user would have to first access GLOCO’s main website, GLOCO.com. Then, navigate to products and make a selection. From there, the user would then need to go to order processing to initiate a purchase order. And from there, to shipping to input shipping address information. Next, billing would have to be contacted to accept credit card information. Finally, checkout would be initiated by the customer. And once it succeeds, the order confirmation would be received. There are many steps and therefore many chances that the customer will fail to order or simply lose interest.

Figure 2 shows an example of a reorder of medical equipment. Our new CUI would allow end customers to simply start the GLOCO mobile phone, select the CUI, and start talking. The customer would only need to request a reorder and then the mobile app would confirm the order and initiate the reorder using the data already stored by GLOCO about the customer. The simple interaction ensures all customers are able to make the orders they need.

Figure 2: GLOCO CUI To-Be Diagram

The proposed To-Be process is much simpler from the customer perspective, but is only possible thanks to the use of the latest developments in Machine Learning (ML) and Big Data.
2.2 Business Problem

GLOCO conducted a survey to gauge convenience and usability among individual customers. Based on the survey results and other data, this section describes some of the issues that GLOCO is currently facing and why GLOCO is losing its competitive edge:

- Existing mobile and web apps are difficult to use for customers over 65 (this represents 45% GLOCO’s customer base)
- People will accessibility needs are having difficulty navigating the GLOCO website
- Conversion rates are low, mobile app telemetry showed that 65% of consumers are placing items in the shopping cart but not completing the purchasing transaction
- Data correlation shows that 30% of incomplete transactions were later completed by a direct phone order required support staff
- The remaining 35% of incomplete transactions were never completed
- Monitoring of medical equipment is a challenge for consumers.

2.3 Business Objectives

These are the following objectives for GLOCO CUI:

- Increase customer satisfaction when dealing with GLOCO web and mobile applications.
- Drive consumers from all market segments (including elderly and disabled consumers) to use the mobile and web application capabilities.
- Gain competitive advantage over close competitors.
- Make tools easier to use for customers.
- Reduce requests for customer service support.
- Increase online sales through the mobile app with verbal requests.

2.4 Business Epic and User Stories

**Business Epic**

Add a Conversational User Interface (CUI) to GLOCO web and mobile apps.

**User Story 1**

As a consumer, I want to be able to verbally ask the GLOCO application about whether specific medical equipment is available and what is the equipment features and price. I want the GLOCO app to provide this information to me orally and without having to navigate the application.
Acceptance Criteria:
The application shall translate the consumer’s verbal request to commands and interface with the GLOCO consolidated API gateway which will query the supply chain management system, and provide information on products, description, and prices verbally and visually.

User Story 2
As a consumer I want to use voice to be able to complete a purchase online verbally, without navigating the application or calling the service desk.

Acceptance Criteria:
The app shall translate the consumer’s verbal request to commands and interface with the GLOCO consolidated API gateway which will in turn place an order through the CRM and ERP systems. The GLOCO app will orally confirm the receipt of the order and expected delivery date.

User Story 3
As a product manager, I want all customer segments (including elderly and disabled people) to be able to verbally complete their entire purchasing transactions.

Acceptance Criteria:
The app shall become intuitive and be able to translate the consumer’s verbal request to commands and interface with the GLOCO consolidated API gateway to pass on the instructions to the concerned enterprise system. It will provide a clear verbal response to the consumer's oral queries and instructions.

User Story 4
As a consumer, I want to be able to verbally ask GLOCO app about the status of devices that I have purchased and are currently installed in my home. I also want the app to orally respond to my queries and verbally alert me when one of my devices is not functioning properly.

Acceptance Criteria:
The app shall translate the customer’s verbal request and interface with the API gateway which will in turn query the data from the IoT system, retrieve the data, and present the information to the user vocally. Once an alert is received from the medical equipment, the app will verbally announce that there is a device error.
2.5 Required Functionality

Below is a list of the functional and non-functional requirements.

Note that GLOCO does not collect medical information around any of its equipment users, and therefore the company is not subject to HIPPA audits. The existing web and mobile application fulfills the PCI DSS requirements for online credit card purchasing.

**Functional Requirements**

- Ability to process spoken natural language and translate it to text.
- Ability to process textual natural language into GLOCO Consolidated Gateway API calls.
- Enable product purchases via voice.
- Enable product availability and price queries via voice.
- Provide new CUI option in existing GLOCO mobile applications.
- Enable instrumentation to record the usage of CUI through the use of telemetry.
- Provide new dashboards and reports of CUI usage for existing GLOCO enterprise portal.
- Ability to receive responses from the GLOCO consolidated API and forward those to users in text and verbal format.

**Nonfunctional Requirements**

- Improve usability of GLOCO mobile app.
- Provide easy-to-follow verbal cues and responses.
- Provide users with a variety of pleasant voices to converse with to enhance usability.
- Provide intuitive online support.
- Ensure app and data collected are secure.

2.6 Success Metrics

A list of metrics was created according to each of the Business goals in measuring how successful this project would be. According to figure 3, fifteen percent of increase in net promoter score is expected as we say that we successfully increased customer satisfaction by implementing CUI for GLOCO. Additionally, 20 percent increase in app traffic and customer satisfaction survey score, 15 percent increase in market share, 10 percent reduction in labor cost, and 30 percent increase in conversion rate are also expected relative to measure the success of each business goals.

The numbers in this list of success metrics are generated by several prediction methods including but not limited to the business analysis report, marketing report, and financial
predicting models. However, these numbers can still be shaped by later process of this project. Thus, we will keep these predictions at this point, and will come back to make any modifications or adjustments later if needed.

<table>
<thead>
<tr>
<th>Business Goal</th>
<th>Success Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase customer satisfaction when dealing with GLOCO</td>
<td>Increase net promoter score by 15%</td>
</tr>
<tr>
<td>Drive consumers from all market segments (including elderly and disabled</td>
<td>Increase app traffic by 20%</td>
</tr>
<tr>
<td>consumers) to use the mobile and web application capabilities</td>
<td></td>
</tr>
<tr>
<td>Gain competitive advantage over close competitors</td>
<td>Increase market share by 15%</td>
</tr>
<tr>
<td>Make tools easier to use for customers</td>
<td>Increase customer satisfaction survey scores by 20%</td>
</tr>
<tr>
<td>Reduce requests for customer service support</td>
<td>Reduce cost for customer service staff by 10%</td>
</tr>
<tr>
<td>Increase online sales through the mobile app with verbal requests</td>
<td>Increase conversion rate for app sales by 30%</td>
</tr>
</tbody>
</table>

Table 1: Table of Success Metrics

### 2.7 Business Benefits Justification

As we mentioned before, GLOCO has decided to outsource the technical part of this project to a third party vendor. The CIO has assigned a budget of 5 million dollars for this project. In addition to that, an additional budget of 1 million dollars is estimated for annual maintenance cost after the initial implementation.

Return on investment (ROI) is associated with the success metrics. We have divided returns into two categories, tangible and intangible benefits. Tangible benefits could be evaluated by numbers directly. For instance, we estimated an increase of 10 percent in net sale per year due to increased market share. Intangible benefits could not be reflected directly by numbers, but they play a key role in establishing long term competitive advantages.

#### Cost of Implementing CUI

- Estimated implementation cost: ~ $5 Million (~7% of total revenue)
- Estimated maintenance cost: ~ $1 Million per year

#### ROI and Tangible Benefits

- Estimated increase in net sale of ~10% per year
- Reduce labor cost of customer service by ~10%
ROI and Intangible Benefits

- Estimated increase of ~10% of customer population next year
- Retain competitive advantage in market
- Increase in customer satisfaction rating

3. Technical Specifications

3.1 Architectural Approach

The GLOCO CUI, built using the API.AI technology, adds the conversational functionality as an enhancement to GLOCO’s existing website and mobile applications.

3.1.1 Architecture Components

- **GLOCO website or mobile application on iOS and Android:** These are equipped with the API.AI JavaScript SDK. This client side SDK handles audio recording and streaming on the user’s device.

- **Controller:** The controller centrally manages the full interaction. It routes natural language order requests to and from the API.AI agent. The controller also manages the fulfillment of order requests.

- **API.AI Agent:** does speech recognition and converts natural language into actionable data. It performs natural language understanding by matching the order text input to pre-existing purchasing intents and domains (detailed in section 3.2.4). The agent also manages the full conversation flow.

- **CUI Request Database:** Incoming natural language requests and outgoing fulfilled requests are recorded in the CUI Request Database for analysis and visualization purposes.

- **GLOCO API Gateway:** The GLOCO API gateway interfaces with both the controller and the existing enterprise CRM and Finance systems in the backend.

- **Enterprise CRM and Finance systems:** These enterprise systems fulfill purchase order requests.

The GLOCO mobile and web applications, API gateway and CRM and Financial enterprise systems are pre-existing components. The Controller and the CUI Request Database will be built by GLOCO and hosted on premise. The API.AI Agent is provided by a third party, API.AI, and hosted in a public cloud.
3.1.2 Diagram Description

The order of operations illustrated in Figure 3 is described below:

1. A user sends natural language text or sound file (wav) from the mobile application or website to the control as POST (HTTP) requests.
2. The controller records the incoming request in the CUI Request Database.
3. The controller forwards the natural language text or sound file to the third-party API.AI agent.
4. The API.AI Agent does speech recognition and converts the natural language to text. Then it performs natural language understanding, and returns actionable JSON objects to the controller.
5. The controller begins the fulfillment process. It sends the JSON objects using Python to the GLOCO API gateway, which in turn send the purchase request to the CRM system. The CRM system sends payment information to the financial system if needed.
6. The CRM and financial enterprise systems return a response to the GLOCO API gateway which provides it to the controller.
7. The controller records the returned response in the CUI request database.
8. The controller sends the response to the API.AI agent which converts it back to natural language.
9. API.AI agent sends the natural language response back to the controller.
10. The controller sends the response to the user’s device in natural language format.

### 3.2 Software Solution

#### 3.2.1 Solution Selection – API.AI

API.AI, a natural language processing company acquired by Google, has become one of the key players in CUI platform development field. This is attributed to its leading technology in deep learning methods,

GLOCO ICT chose API.AI because it has the following key advantages:
- Holds competitive advantage with its most advanced speech and intent recognition, dialog understanding and management technology.
- Supports 15 different languages including English, Chinese, and Spanish.
- Provides very simple design and integration process.
- Supports multiple systems and platforms with one single CUI.
- Requires minimal development cost.
- Has great potential for future development with Google’s support.

#### 3.2.2 API.AI Functional Infrastructure

Api.ai CUI follows a 4-level workflow in building any human-level dialogs:

- Speech Recognition - transcribes voice into readable text with Automatic Speech Recognition (ASR).
- Natural Language Understanding - interpret the meaning of transcribed text and understand the intent of user’s command.
- Fulfillment - deliver user requests to the CUI controller for further action to be processed, and receive information from the CUI controller. This is the step to turn conversation into real action.
- Conversational Management - supports back and forth dialogue and creates meaningful dialogue.

As illustrated in Figure 4, any incoming request is processed following this diagram to transcribe input, understand user’s intent, retrieve useful information and create intelligent
responses. This process is repeated for each incoming inquiry, and a human-level conversation can be build.

![Api.ai Functional Infrastructure Diagram](image)

**Figure 4: Api.ai Functional Infrastructure Diagram.**

### 3.2.3 CUI Controller

When we speak of the CUI it is really a system of several modularized components. The central processor will be the CUI Controller, a component that we will develop in-house to connect all of the other components together. The CUI Controller is the central clearinghouse for all operations.

As it will primarily serve to connect a number of web based REST interfaces we felt it was important to use a toolset that is efficient for web applications but one that is also not burdensome to manage. We have decided to build the CUI Controller as a Python application using the Flask framework. Python was chosen for a number of reasons:

- It is a powerful language without a significant learning curve.
- The third-party processors that we are considering all support Python.
- Python is very extensible and has numerous libraries for connecting with various systems such as databases, HDFS, etc.
- It is one of the primary and preferred languages for Data Science applications.

The general flow of processing will begin with users speaking into a mobile device. That device will forward a .wav file to the CUI Controller. The Controller will act as the intermediary
between the user and API.AI. Once a user request is fully understood the CUI Controller will interact with the GLOCO API Gateway for internal processing of the purchase request with the CRM and financial systems. It will then communicate to API.AI to get the user response and will forward the response to the user.

Example flow of a request though the CUI Controller:

![Diagram: Request flow through the CUI controller]

**Figure 5 - Request flow through the CUI controller**

### 3.2.4 API.AI Design Model Description and Diagrams

API.AI provides its own console for GLOCO developers to design and integrate the conversational user interface according to business requirements.

The creation of basic CUI function involves 3 parts:

- **Agent** - represents one conversational interface supporting one language. For a different language, a new agent is needed. Developer creates an Agent by assign a name, language, machine learning level and other parameters. GLOCO’s first API.AI Agent will be in English.
• **Intents** - describes user’s purpose by saying certain things. Intents are designed and manually created by developers specifically according to the functional requirements of each business. Since each intent supports one functional requirement, there are usually multiple intents required for a comprehensive Agent. For example, we expect users to place orders, check device status through the Agent, then ‘order’ and ‘check_status’ will be two of the intents to create.

• **Entities** - work as categories that can map and capture the meaning of natural language phrases. Multiple parameters may be needed to fully describe an entity. Entities are also manually defined and created by developers according to business needs. For example, if we have entities ‘product_name’, ‘user_id’, ‘shipping’, the intent order might require entity ‘product_name’ and ‘shipping’ to fully describe it, whereas the intent check_status might require ‘product_name’ and ‘user_id’ to obtain complete information.

**Training**

The API.AI Agent adopts advanced deep learning technology, and thus the training process is one of the critical configuration steps for the agent to function efficiently. After all the intents and entities are created by the GLOCO developers, several sample user statements are provided to train the agent to detect the user’s purpose and context. The agent could be able to automatically detect user’s intent and entities from what user said after training it. As a deliverable product, the expected functionality is as following:

• When the user sends a request in natural language, the agent is able to detect the intent, and call-up intent with JSON.

• When Intent is called, a list of corresponding entities linked with this intent are also called-up and checked one by one to see if the user provided related information.

• If information for any required entity (or parameter) was not provided, the agent asks further questions for the user to provide additional information.

• If all entities are fulfilled, the agent is ready to send intent and entity information to the CUI Controller for fulfillment of the request and it waits for a response to complete the action.

The training process is the key enabler for the Agent to achieve human level conversation with high level intelligence. By saying human level conversation, we will not limit users to follow a predefined sentence structure to communicate; instead, GLOCO Agent will be trained to be able to understand different form of human expression. With a comprehensive training for the machine learning process, by the time of actual product release and implementation, the GLOCO Agent will be able to detect and relate synonyms, understand different spoken language
structure, thus understand user when they say the same meaning with different expression. Additionally, the Agent is intelligent enough to collect errors, learn from mistakes, improve from its learning algorithm, and never perform the same mistake again. Thus, with a continuous learning process, our Agent will be able to meet user’s expectation and increase user experience.

Figure 4 demonstrates a basic view of the API.AI console and the training process. The agent is named ‘GLOCO_English’, and the intent ‘intent_order’ and a list of entities are created as well. The agent is learning to capture entity information from provided sentences.

Figure 6: Api.ai console review

### 3.2.5 System Metrics

API.AI offers different pricing packages with different supporting metrics. In the early implementation phase, we plan to use the standard version which provides the following metrics:

- 750,000 queries per year
- Unlimited private agents and pre-built domains
- Custom models available for speech recognition (significantly increase accuracy)
- Guaranteed to meet SLA

Due to the large size of our company and large amount of potential users, we do expect our queries per year to grow rapidly. We will monitor the amount of the queries. As long as the number is getting close to the service limit, we will upgrade our package accordingly.
### 3.3 Integration with Applications and Data Sources

Below is a list of applications and components that we’re integrating:

- Api.ai agent
- Mobile app
- Web application
- CUI Controller
- GLOCO Consolidated API Gateway
- CRM
- CUI Request Database

The CUI Controller, API.AI agent, and the CUI Request Database are being newly introduced to GLOCO. All remaining applications are existing applications and are already fully integrated together. Therefore, we’ll restrict our discussion around the API.AI agent, CUI controller and the gateway interface.

GLOCO has a web application and a mobile app. GLOCO will create the agent using the API.AI developer console and use the agent with the JavaScript SDK. The agent will be embedded in GLOCO’s existing website. For the existing mobile app, the web application will simply be embedded into the mobile app for Android and iOS devices. For Android, the WebView class can be used, and the WKWebView class can be used for iOS.

The CUI controller will integrate with the company’s existing CRM through the GLOCO API Gateway using the HTTP protocol. This RESTful API makes HTTP requests and exchanges data using JSON. A RESTful API is an application program interface (API) which uses HTTP requests to GET, PUT, POST, and DELETE data. The GLOCO API Gateway relays the context of the queries and responses between the Controller and existing CRM and financial enterprise systems. Please refer to the Figure 7 below for further explanation.

#### 3.3.1 Query Processing

Here is a list of some of the queries that may originate from the conversation with the customer:

- Enquire about a product
- Place an order
- Track shipment
- Query about previous orders
Figure 7 – Query Processing

Queries

1: Enquire about a product
   1a: query context sent from CUI Rest Interface to Gateway
   1b: query context sent from Gateway to CRM
   1c: context of response sent from CRM to Gateway
   1d: context of response sent from Gateway to CUI Rest Interface

2: Place an order
   (same as 1a to 1d)

3: Track shipment
   (same as 1a to 1d)

4: Reorder the same product
   (same as 1a to 1d)

These queries may dynamically increase in number over a period of time because Api.ai will learn more about the users and the products with its machine learning capabilities.

When a user makes a request to the CUI, the speech will be captured as a WAV file on any common browser. Using POST, that WAV file is sent to Api.ai, which then completes speech to text conversion. The text may not have the complete details for the query to be executed in the CRM. Api.ai has the capability to get the missing parameters from the user through a conversation. It will complete the parameters for each query. This query will then be passed to the GLOCO Consolidated API Gateway.
Example: Customer says, “I want to purchase a pump.” At this stage, you only know the customer ID, not the product ID. API.AI will ask further questions to the customer to get other details required to process the order.

### 3.3.2 Analytics and Visualization

The existing dashboard in the CRM will continue to show all the relevant information like sales through different channels (through mobile app, web application, or via phone call).

The CUI Request Database captures all the natural language verbal and typed queries to the application, which is anonymized and recorded for analytics. The information of the query is sent to the CRM via the GLOCO Consolidated Gateway. Analytical tools access the CUI Request Database and present the reports on the dashboard and help track the trend of CUI use.

### 3.4 Data Design & Management

The CUI enhancement for GLOCO will attempt to minimize the introduction of new data-at-rest. GLOCO’s existing Enterprise Systems will continue to serve as the Systems of Record for all important customer information and historical transaction data. Instead, the CUI enhancement will introduce new entities primarily for data-in-use interactions between the CUI and the existing GLOCO API Gateway. The only new stored entities will be the anonymized natural language queries.

#### 3.4.1 Entities

**Inquiry:**

<table>
<thead>
<tr>
<th>#</th>
<th>Field Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Id</td>
<td>String</td>
<td>Identifier for the inquiry</td>
</tr>
<tr>
<td>2</td>
<td>Keyword</td>
<td>String</td>
<td>Keyword used to search for a product</td>
</tr>
<tr>
<td>3</td>
<td>Color</td>
<td>String (optional)</td>
<td>Desired color</td>
</tr>
<tr>
<td>4</td>
<td>Quantity</td>
<td>Number (optional)</td>
<td>Desired number</td>
</tr>
<tr>
<td>5</td>
<td>Size</td>
<td>String (optional)</td>
<td>Desired size</td>
</tr>
<tr>
<td>6</td>
<td>Full_text</td>
<td>Memo</td>
<td>Full natural language text of inquiry</td>
</tr>
<tr>
<td>7</td>
<td>Success</td>
<td>Boolean</td>
<td>Was this inquiry understood by the CUI</td>
</tr>
</tbody>
</table>

*Table 2*

The customer uses natural language to make product inquiries through the CUI. The natural language requests are processed by Api.ai and sent back to the Controller. The Controller translates the inquiries into Inquiry entities and forwards them to the GLOCO API Gateway. This data is stored.
**Product:**

<table>
<thead>
<tr>
<th>#</th>
<th>Field Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Id</td>
<td>String</td>
<td>Identifier for the item</td>
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<tr>
<td>2</td>
<td>Title</td>
<td>String</td>
<td>Title of the item</td>
</tr>
<tr>
<td>3</td>
<td>Description</td>
<td>Memo</td>
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<td>4</td>
<td>Category</td>
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<td>5</td>
<td>Link</td>
<td>String</td>
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<td>6</td>
<td>Availability</td>
<td>String</td>
<td>Availability status</td>
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<td>7</td>
<td>Availability Date</td>
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<tr>
<td>15</td>
<td>Tax</td>
<td>Number</td>
<td>Applicable tax</td>
</tr>
</tbody>
</table>

*Table 3*

The Product entity is used in response to customer product inquiries. Inquiries are made through the CUI and passed through to the GLOCO API Gateway. The Gateway queries GLOCO legacy Enterprise systems and responds with a Product entity represented as JSON. This data is never stored.

**Order:**

<table>
<thead>
<tr>
<th>#</th>
<th>Field Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Id</td>
<td>String</td>
<td>Identifier for the order</td>
</tr>
<tr>
<td>2</td>
<td>Customer_Id</td>
<td>String</td>
<td>Identifier of customer placing order</td>
</tr>
<tr>
<td>3</td>
<td>Product_Id</td>
<td>String</td>
<td>Identifier of product ordered</td>
</tr>
<tr>
<td>4</td>
<td>Quantity</td>
<td>Number</td>
<td>Number purchased</td>
</tr>
<tr>
<td>5</td>
<td>Color (optional)</td>
<td>String</td>
<td>Color of item</td>
</tr>
<tr>
<td>6</td>
<td>Size (optional)</td>
<td>String</td>
<td>Size of item</td>
</tr>
</tbody>
</table>

*Table 4*

The Order entity is generated by the Controller once a customer makes an order request. The Controller sends the order entry back to the CUI for confirmation. The order details are then presented to the user verbally and/or textually. Once the customer has confirmed the order details, the order is passed to the GLOCO API Gateway for processing. This data is never stored.
Shipment:

<table>
<thead>
<tr>
<th>#</th>
<th>Field Name</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Id</td>
<td>String</td>
<td>Identifier of the shipment</td>
</tr>
<tr>
<td>2</td>
<td>Street</td>
<td>String</td>
<td>Street address</td>
</tr>
<tr>
<td>3</td>
<td>City</td>
<td>String</td>
<td>City</td>
</tr>
<tr>
<td>4</td>
<td>State</td>
<td>String</td>
<td>Date available</td>
</tr>
<tr>
<td>5</td>
<td>Country</td>
<td>String</td>
<td>Price of item</td>
</tr>
<tr>
<td>6</td>
<td>Zip</td>
<td>String</td>
<td>Currency of item</td>
</tr>
<tr>
<td>7</td>
<td>Tracking_number (optional)</td>
<td>String</td>
<td>Tracking number for the shipment</td>
</tr>
</tbody>
</table>

*Table 5*

The Shipment entity is returned from the GLOCO API Gateway once an order has been successfully submitted, processed, and shipped by the GLOCO’s existing legacy order management system. The Shipment is forwarded to the Controller and the Controller uses it to have the CUI present the completed shipment details to the user either verbally or textually. This data is never stored.

### 3.4.2 Storage & Analytics

The CUI enhancement only adds storage for customer inquiries, both those successfully processed by the CUI and those that are not. These Inquiry entities will be stored in a NoSQL key-value store database using MongoDB. All stored data will be anonymized and encrypted.

The stored Inquiry entities supplemented with region and timestamp information. The entities will be used to gain analytics about the types of queries made, the language and phrases most often used when and where, and to improve the user experience by finding edge cases and new phrases to process.

### 3.5 Solution Demonstration

Below is a basic demo showing how the GLOCO CUI would respond to customer who wants to place an order. This demo agent can perfectly understand user’s intent(Order), collect required information, and complete order through human-dialogue style communication. In order to clearly explain the working algorithm, only one function is demonstrated here. However, the actual product will be far more comprehensive and multi-functional than this simple demo.
**Screenshot 1:** GLOCO_English
Agent interface. User can easily start to chat by clicking the microphone icon.

**Screenshot 2**: User wants to buy a glucose monitor. The agent understood the user’s intent, checked all the entities and found out that the parameter “address” is missing. Therefore, agent asks user to indicate address.

**Screenshot 3**: The user indicated the address, agent check through entities again, and found out that shipping method is still missing. So agent asked about the shipping method.
4. Implementation Plan

4.1 Solution Delivery Roadmap

4.1.1 Delivery Strategy

The CUI enhancement will be developed and deployed using agile practices. Sprints will typically be one month in length. Activities that can be reasonably divided to occur in parallel will be so divided.

At the end of each sprint, a deliverable product will be demonstrated. Software and configuration products will be demonstrated to an audience to the extent possible given the functionality available. Services will be brought online, performance metrics collected, and event monitoring will commence. Documentation will be presented and subject to peer review.

4.1.2 Deliverables

<table>
<thead>
<tr>
<th>Sprint #</th>
<th>Deliverable</th>
<th>Type</th>
<th>Description</th>
<th>Team(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CUI Hosting Environments</td>
<td>Service</td>
<td>Set up and test hosting environments for development, test, and production</td>
<td>Enterprise Architect, Solution Architect</td>
</tr>
<tr>
<td>2</td>
<td>CUI Controller</td>
<td>Software</td>
<td>Perform user requests/requests</td>
<td>Solution</td>
</tr>
</tbody>
</table>

Screenshot 4: Agent has all the information needed to complete an order now, it sent all the information to the CUI Controller, and replied to the user with a confirmation.
<table>
<thead>
<tr>
<th></th>
<th>Mobile Integration Component</th>
<th>Software</th>
<th>Add CUI to the interface of the existing GLOCO mobile app</th>
<th>Solution Architect Development Team</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Web Integration Component</td>
<td>Software</td>
<td>Add CUI to the interface of the existing GLOCO website</td>
<td>Solution Architect Development Team</td>
</tr>
<tr>
<td>4</td>
<td>Conversational scripts</td>
<td>Documentation</td>
<td>Scripts that detail supported conversations that may happen between users and the CUI</td>
<td>Agent Development Team</td>
</tr>
<tr>
<td>5</td>
<td>CUI Api.ai Agents</td>
<td>Configuration</td>
<td>Create agents to implement the conversational scripts in each target language</td>
<td>Agent Development Team</td>
</tr>
<tr>
<td>6</td>
<td>Reorder Script Implemented</td>
<td>Configuration</td>
<td>Create and demonstrate reorder functionality</td>
<td>Agent Development Team Development Team</td>
</tr>
<tr>
<td>7</td>
<td>Availability Script Implemented</td>
<td>Configuration</td>
<td>Create and demonstrate product availability functionality</td>
<td>Agent Development Team Development Team</td>
</tr>
<tr>
<td>8</td>
<td>Order Script Implemented</td>
<td>Configuration</td>
<td>Create and demonstrate new order functionality</td>
<td>Agent Development Team Development Team</td>
</tr>
<tr>
<td>9</td>
<td>CUI Database and Dashboards</td>
<td>Software</td>
<td>Create and demonstrate dashboard and analytics functionality</td>
<td>Development Team Database Management Team</td>
</tr>
<tr>
<td>10</td>
<td>Staff Operational Support Trial</td>
<td>Service</td>
<td>Staff are trained and demonstrate CUI support scenarios</td>
<td>QA Team Reliability Engineering Team</td>
</tr>
</tbody>
</table>

*Table 6*
4.1.3 Schedule

![Schedule Diagram]

Figure 8 - Schedule

4.1.4 Service Transition

The CUI enhancement for GLOCO is a greenfield deployment that is layered on top of existing systems. As such, there is no downtime or service degradation required for existing GLOCO systems to deploy the new service.

The transition will occur seamlessly and will become live as the website and mobile components are made available to users. The components will be piloted in 4 phases. The user population with access to the enhancement will be expanded at each phase. First, 10% of users will have access, then 25%, 50%, and in the final phase 100%. At each phase, performance and user adoption rate of the enhancement will be measured.

If any problems are encountered or risks realized during rollout, the rollback plan will be to disable component availability until the issues can be resolved. Once resolved, components will be re-enabled and the rollout pilot resumed.

4.1.5 Data Transition

The CUI enhancement for GLOCO does not require the migration of data from existing systems. All CUI enhancement components will pull data from systems-of-record through the GLOCO Consolidated Gateway API.

The CUI does, however, require the introduction of a new data repository, the CUI Request Database. At the time of deployment, the CUI Request Database will contain no existing data. The system will be tested to ensure that the storage of new data is successful, but no migration or data population is required at the time of deployment. Subsequent to deployment, all requests will be recorded there.
### 4.1.6 Transition Risks

<table>
<thead>
<tr>
<th>#</th>
<th>Risk</th>
<th>Impact</th>
<th>Likelihood</th>
<th>Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cloud-based Api.ai is unable to service the full volume of requests in a manner that meets user performance expectations</td>
<td>High</td>
<td>Low</td>
<td>Migrate to a high performance locally hosted Api.ai instance</td>
</tr>
<tr>
<td>2</td>
<td>Changes to Api.ai programming interface cause a loss of service</td>
<td>High</td>
<td>Medium</td>
<td>Within the controller, a single module provides the interface to Api.ai with rigorous automated tests that actively run and monitored</td>
</tr>
<tr>
<td>3</td>
<td>CUI enhancement components to existing apps are difficult for users to find/use</td>
<td>High</td>
<td>Medium</td>
<td>Usability trials are conducted. Components are instrumented so that usage telemetry can be collected</td>
</tr>
<tr>
<td>4</td>
<td>Api.ai speech recognition falls short of user expectations for some languages/users</td>
<td>Medium</td>
<td>Low</td>
<td>Samples of user queries are taken from CUI Request Database and used for Api.ai training</td>
</tr>
<tr>
<td>5</td>
<td>GLOCO Consolidated Gateway API does not support all the required interfaces to existing systems-of-record</td>
<td>Medium</td>
<td>Medium</td>
<td>Engage ICT GLOCO Consolidated Gateway API team early with information on proposal and required interface. Be prepared with financial resources in reserve in case Gateway requires expansion</td>
</tr>
<tr>
<td>6</td>
<td>Existing network bandwidth is unable to handle the volume of audio requests to Api.ai</td>
<td>Low</td>
<td>Low</td>
<td>Incorporate query caching and volume throttling into Controller and be prepared to upgrade existing bandwidth to process the volume of requests</td>
</tr>
</tbody>
</table>

*Table 7*

### 4.2 Operationalization

As the central focus of the CUI is to improve the overall user experience, operationalizing the system without causing impact is paramount. From the user perspective, GLOCO already maintains a global service desk with a “follow the sun” support model so that users in all geographic areas and time zone receive equal support. The technologies comprising the CUI rely heavily on machine learning to function correctly. This has the potential to cause a non-trivial percentage of errors which could lead to user frustration. We will rely on the pre-existing “live help” feature already embedded in the GLOCO mobile applications so that the users can get support from a live person if the system isn’t working correctly.

All teams involved will have at least ten people in each team. The development of the CUI system will be managed by the CUI Development Team, a new team within GLOCO ICT. This
team will be responsible for initial development as well as designing new features. Day-to-day operations will require the formation of a new Reliability Engineering team. The Reliability Engineering team will be responsible for managing the internal infrastructure required to run the CUI as well as the connections to the third party vendors. This team will be responsible for configuring the correct alerting, monitoring, and log aggregations.

The Reliability Engineering team will own the release and maintenance process for the CUI. They will work closely with the CUI Development Team to determine an appropriate release cadence and to understand all changes to the system. They will also be responsible for following the incident management process for any issues that occur with the CUI system.

<table>
<thead>
<tr>
<th>Role/Team</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Sponsor (GLOCO CTO)</td>
<td>Ensure the project delivers the business benefits</td>
</tr>
<tr>
<td>Project Manager</td>
<td>Has overall responsibility for planning, procurement, and execution of project</td>
</tr>
<tr>
<td>Enterprise Architect</td>
<td>Integration of CUI with existing systems</td>
</tr>
<tr>
<td>Solution Architect</td>
<td>Create blueprint of the solution</td>
</tr>
<tr>
<td>Development Team</td>
<td>• Incorporate additional code for CUI into GLOCO app</td>
</tr>
<tr>
<td></td>
<td>• Develop Controller to handle routing to and from API.AI agent, CUI Request Database, and GLOCO app</td>
</tr>
<tr>
<td></td>
<td>• Develop for front-end of web and mobile apps to include CUI option</td>
</tr>
<tr>
<td>Database Management Team</td>
<td>Build CUI Request Database</td>
</tr>
<tr>
<td>Agent Development Team</td>
<td>• Design and produce the agent, its intents and entities, contexts, etc. using the API.AI developer console</td>
</tr>
<tr>
<td></td>
<td>• Embed the agent into GLOCO’s apps</td>
</tr>
<tr>
<td></td>
<td>• Finalize integration of the CUI with existing systems</td>
</tr>
<tr>
<td>QA Team</td>
<td>Test the GLOCO app with the integrated CUI to identify and prevent any issues</td>
</tr>
<tr>
<td>Reliability Engineering Team</td>
<td>Release and maintenance process for the CUI</td>
</tr>
</tbody>
</table>

Table 8

4.2.1 Supporting Non-Functional Components

The non-functional components listed below will help with the CUI implementation.

- **User Administration Console**: This will help global user administrators with certain tasks such as viewing information on users, creating new users, resetting user passwords, and searching for users by user attributes
- **CUI Request Database**: One of our core components the CUI Request Database which stores all requests and transactions. This database will allow our support personnel to
seamlessly continue a transaction that had been started during a CUI session. One of the pre-launch tasks will be to provide robust training for the GLOCO support teams to be able to quickly support users when they are having issues.

4.2.2 Change Management
The same change management process GLOCO has will still be followed. Once the CUI has been integrated into GLOCO’s apps, additional changes are expected to be made for the agent when it receives more requests. The agent may not understand some of those requests. All the requests, including the unhandled requests are within the CUI Request Database. A change request must be placed to be reviewed by the change advisory board (CAB). If the CAB approves, schedules are made for the change request to move to production for the next release. Every month, additional changes will follow the steps provided below:

1. Identify and extract unhandled CUI requests
2. Train the agent by providing additional necessary intents and entities
3. Perform testing with the modified agent

4.2.3 Service Level Agreements
Having a service level agreement is vital as GLOCO is relying on Api.ai’s service to integrate the CUI features to the apps. GLOCO will select the appropriate pricing plan to have a service level agreement (SLA) with Api.ai to establish expectations in terms of Api.ai’s performance. They provide a 99.99% guaranteed uptime as stated on their website.

4.3 User Enablement
GLOCO’s CUI interface changes the way customers interact with the GLOCO website and mobile application to make new orders. Therefore, GLOCO ICT developed the below plan to ensure the customers’ adoption of the new CUI feature:

• User Experience Testing: Ahead of the CUI feature release, GLOCO will conduct user experience testing with a limited group of users. The users will be asked to share feedback about their experience with the tool. This will help GLOCO identify issues and areas of improvement from the user’s perspective early on.

• Marketing Campaign: The campaign is intended to inform GLOCO customers of the newly introduced CUI feature and the benefits of using it. The campaign will consist of the following:
- Video advertisement demonstrating the CUI use. The video will be featured on GLOCO’s website, mobile application and social media pages.
- Customers will receive emails and notifications from the mobile application introducing them to the new feature.
- User incentives: GLOCO will offer discounts for the first 100 users that use the CUI feature to complete a purchase order.

• **User Guides:** Video and illustrated user guides will demonstrate the use of CUI to make a purchase. These will be more elaborate than the advertisement. They will be available on the GLOCO website, mobile application and social media pages for the user’s reference. The “Frequently Asked Questions” section in GLOCO’s website will be updated with expected user concerns around the CUI feature.

• **User Feedback through Feedback Ratings and Reports:** Customers that use the CUI feature will be requested to rate it on a scale from 1 – 5 stars. They will also have an option to share comments. GLOCO will use the feedback received from these direct feedback channels as well as feedback received in emails or calls to GLOCO, to identify areas of improving the CUI.

• **Track and Measure Metrics to Gain Greater Visibility:** GLOCO will set targets for user adoption of the CUI tool in the first 6 months of the release and it will track the number of orders placed through the CUI and compare it to the targets to track user adoption of the feature. It will also track numbers of users that show interest in the advertisement, refer to the user guides, and share feedback.

Additionally, GLOCO also tailored training for the internal users who will be providing support for the CUI, as well as high-level familiarization training for the management team. The table below shows the GLOCO internal function groups that will receive training, the topic they will be trained on and their training methodology.

<table>
<thead>
<tr>
<th>User Group</th>
<th>Training Topics</th>
<th>Training Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT Help Desk Agents</td>
<td>CUI system basic troubleshooting</td>
<td>Formal 2 day training course, Documentation.</td>
</tr>
<tr>
<td>Customer Service Agents</td>
<td>Basic CUI functionality</td>
<td>Documentation, User Guides, Meeting.</td>
</tr>
<tr>
<td>CUI System Administrators</td>
<td>CUI advanced configuration, API.AI natural language processing and fulfillment, CUI controller operation and fulfillment.</td>
<td>Formal 2 week training course, documentation.</td>
</tr>
<tr>
<td>Management Team</td>
<td>CUI Dashboard</td>
<td>Formal half day training and user guides.</td>
</tr>
</tbody>
</table>
### 4.4 Success Metrics

The following business and technical success metrics table is adjusted based on each business goals and technical categories. During the first year of implementation, the product emphasis will be on CUI basic functionality and user learning process and adoption. Thus a relatively small increase/decrease in metrics is expected. Over 2 years of implementation, the CUI product is mature in most functionality, and the key focus shifts from learning process to user expansion. Thus, higher benefits are expected.

#### Business Success Metrics Table

<table>
<thead>
<tr>
<th>Business Goal</th>
<th>Success Metric - 1 Year</th>
<th>Success Metric - 2 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase customer satisfaction when dealing with GLOCO</td>
<td>Increase net promoter score by 5%</td>
<td>Increase net promoter score by 15%</td>
</tr>
<tr>
<td>Drive consumers from all market segments (including elderly and disabled consumers) to use the mobile and web application capabilities</td>
<td>Increase app traffic by 10%</td>
<td>Increase app traffic by 20%</td>
</tr>
<tr>
<td>Gain competitive advantage over close competitors</td>
<td>Increase market share by 10%</td>
<td>Increase market share by 20%</td>
</tr>
<tr>
<td>Make tools easier to use for customers</td>
<td>Increase customer satisfaction survey scores by 5%</td>
<td>Increase customer satisfaction survey scores by 20%</td>
</tr>
<tr>
<td>Reduce requests for customer service support</td>
<td>Reduce cost for customer service staff by 10%</td>
<td>Reduce cost for customer service staff by 15%</td>
</tr>
<tr>
<td>Increase online sales through the mobile app with verbal requests</td>
<td>Increase conversion rate for app sales by 10%</td>
<td>Increase conversion rate for app sales by 30%</td>
</tr>
</tbody>
</table>

*Table 10*

#### Technical Success Metrics Table

<table>
<thead>
<tr>
<th>Category</th>
<th>Success Metric - 1 Year</th>
<th>Success Metric - 2 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase functions and tasks the GLOCO App supports.</td>
<td>Increase the availability of the App function by 5%</td>
<td>Increase the availability of the App function by 20%</td>
</tr>
<tr>
<td>Enable easier product ordering and related queries via CUI functions.</td>
<td>Increase the performance of ordering process by 5%</td>
<td>Increase the performance of ordering process by 20%</td>
</tr>
<tr>
<td>Increase user experience while using the App by conversational and visual functions.</td>
<td>Increase user experience with the CUI by 10%</td>
<td>Increase user experience with the CUI by 20%</td>
</tr>
<tr>
<td>Reduce the time spending for users to complete a certain task.</td>
<td>Reduce average time spending per task by 10%</td>
<td>Reduce average time spending per task by 15%</td>
</tr>
</tbody>
</table>

*Table 11*
GLOCO has its specific method in collecting data and monitoring success metrics to ensure successful implementation of the CUI product. In the following measurements and evaluation table, for each success metrics listed, type of data/information that is needed is described, and methods for collecting such data and analyzing/evaluating specific metrics are listed. As a result each metric is continuously and carefully monitored, any proper adjustments or changes can be made.

### 4.4.1 Measurements and Evaluations of Success Metrics

<table>
<thead>
<tr>
<th>Success Metrics</th>
<th>What Needs to be Measured</th>
<th>How it will be measured</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase net promoter score by 5%</td>
<td>Customer satisfaction rating and +/- for customer volume number.</td>
<td>Customer satisfaction rating is obtained from monthly customer survey and marketing survey. Customer volume number is collected from user database. Trend for potential users and user satisfaction can be predicted from above data.</td>
</tr>
<tr>
<td>Increase app traffic by 10%</td>
<td>Trend for app traffic volume.</td>
<td>App traffic volume is continuously monitored by existing traffic monitor engine, and detailed data is stored in database. Can answer questions like is the traffic from returning user or new user, is the traffic adding value, and how much traffic is contributed by certain user group?</td>
</tr>
<tr>
<td>Increase market share by 10%</td>
<td>Current market share and trend for market share change.</td>
<td>Market share is continuously measured by marketing department through researches and analysis. Current analysis and predictive trend analysis are available.</td>
</tr>
<tr>
<td>Increase customer satisfaction survey scores by 10%</td>
<td>Customer satisfaction survey score</td>
<td>Customer satisfaction survey is provided once a month, and App rating is collected real time after users leave feedback. Trend analysis is done with above data to keep tracking customer satisfaction score.</td>
</tr>
<tr>
<td>Reduce cost for customer service staff by 10%</td>
<td>Customer service staff number and cost.</td>
<td>Number of user queries and productive working hour for each service staff is reported. Actual required customer service staff number and service hours can be calculated, and cost can be calculated as well.</td>
</tr>
<tr>
<td>Increase conversion rate for app sales by 10%</td>
<td>Number of transactions that completed via App, dropped halfway, or turned to service staff.</td>
<td>Number of transaction completed or dropped halfway via App is recorded at the database, and customer turned from App to service staff is recorded by service staff. Conversion rate is calculated from above data, and a trend can be generated by analysis.</td>
</tr>
<tr>
<td>Increase the availability of the</td>
<td>Number of functions App is able to perform, and which</td>
<td>Usage of App by each user is recorded in the database.</td>
</tr>
<tr>
<td>Action</td>
<td>Description</td>
<td>Methodology</td>
</tr>
<tr>
<td>--------</td>
<td>-------------</td>
<td>-------------</td>
</tr>
<tr>
<td>App function by 5%</td>
<td>ones are most utilized with users.</td>
<td>By comparing available functions and the actual adoption of each function by users, the availability can be analyzed, and potential issue can be detected.</td>
</tr>
<tr>
<td>Increase the performance of ordering process by 5%</td>
<td>User adoption level with CUI ordering process and feedback.</td>
<td>Time and length of each user usage for CUI will be collected, and average learning curve data will be collected as well. Feedback will also be collected to monitor the performance.</td>
</tr>
<tr>
<td>Increase user experience with the CUI by 10%</td>
<td>User satisfaction survey score with new CUI function and feedback.</td>
<td>User survey specifically for CUI will be given for every user after each version release. Customer feedback and user experience rating will be collected and analyzed.</td>
</tr>
<tr>
<td>Reduce average time spending per task by 10%</td>
<td>Average time users spend for completing tasks. (Categorized by task.)</td>
<td>Time for each customer to complete each different task is collected and average time is calculated.</td>
</tr>
</tbody>
</table>

*Table 12*