# Idea

The idea of the research is to understand the open-topic conversations and ways to provide assistance to humans who face difficulties in initiating conversations and overcome the social complex associated with people not being able to talk or have successful conversations.

By providing humans with assistive conversational support, we can augment the conversation that can be carried out. The AdvisorBot can also help to reduce the time taken to type and convey the message if the AdvisorBot is context aware and capable of providing good responses.

# Research Goals

1. Determine linguistic features of textual 1-on-1 chats that predict user satisfaction with a casual, open-topic discussion with a (relative) stranger
2. Devise an automated “advisor” to help individuals have more satisfying chats
3. Determine the quality of the AdvisorBot in terms of accurately providing suggestions that can help achieve fruitful conversations and AdvisorBot’s ability to understand the subjective aspects of the conversations

## Goal 1: Linguistic Analysis

1. Determine linguistic features of textual human-human conversations that result in user satisfaction through a feeling of successful conversation.
2. The conversations will be carried on in the form of one-on-one chats over a casual open-topic discussion with a (relative) stranger.
3. This would enable us to provide information about how two strangers interact and to find some open-topic and context switching to maintain the conversational flow.
4. Provide the users with feedback from existing open domain conversational chatbots that are proven to have successful open-domain conversations with humans.
5. Analyze the context awareness skills of the existing open domain chatbots and determine their use in providing conversational assistance.
6. Deploy interactive chat framework where users can connect with strangers to have conversations which would be used for data gathering.
7. Determine if existing open domain chatbots can provide conversational assistance.
8. Analyze how the existing chatbots were able to understand contextual information to gain information in building the AdvisorBot.
9. Analyze the responses generated from the human users to determine textual features that can help the advisor chatbot to better understand the context and provide appropriate feedback.
10. Find aspects that provide the users with a feeling of sensible satisfactory conversations to measure the subjective and objective measures while having a conversation.
    1. Subjective Measures include:
       1. User Experience
       2. Feeling of relevance
       3. Enjoyment and feeling of conversating more
       4. Impression of chatbot / AdvisorBot
    2. Objective Measures include:
       1. Length of the conversation
       2. Dialogue length / words per message
       3. Coherence / cosine similarity between the suggestions and actual messages sent by the user
       4. Sentiment expressed by the user

## Goal 2: AdvisorBot

1. Deeper delve into the responses from Goal 1 to extract useful information that can help in building the advisor chatbot.
2. Research on data that can be augmented if the data gathered in Goal 1 is insufficient.
3. Apply techniques on user study with three modes of AdvisorBot:
   1. Using AdvisorBot.
   2. Without using AdvisorBot.
   3. Using the baseline model of the AdvisorBot.
4. Deploy the new created AdvisorBot into the interactive chat framework for user testing similar to Goal 1.
5. Analyze how the new AdvisorBot performs to carry out satisfactory conversations.

# Chatbot Interaction Framework

The chatbot interaction framework allows to connect the subject with another subject or a chatbot which allows them to engage in casual open-topic conversations. The use of AdvisorBot would be up to the user and the user may choose not to use the advice from the AdvisorBot.

## User interface

The user interface of the chatbot interaction framework can be divided into three parts

* + - 1. User Registration
      2. Chat Interface
      3. Post-chat questionnaire

### User Registration

The user registration will be based upon the user’s consent and the users will be asked to accept the user’s informed consent form prior to signing up. Initially the users will be asked some general demographic questions that would help this research analyze the sample space of the test subjects that are being used. The users would be required to provide usernames which can be anything that a user would choose as their alias. For password recovery, the subjects would be required to provide with their email address. The demographic information will be attached to the user’s identity but will not be disclosed. This is done to prevent the returning users from filling up the demographic information again.

### Chat Interface

The subjects would be connected to another subject who is online at random or a chatbot picked at random and then the subjects can talk casually over any generic open topic and can switch over topics as the conversation proceeds. The users can also be provided with some initial starting point of the conversation by suggesting to talk about things that may mutually interest the two users and the conversation can then branch or divert from the topic.

The chat interface would consist of messages which users have sent to each other and an additional assistance strip consisting of the chat messages that can be used as the conversational assistance.

The assistance strip would consist of some messages that are generated by open sourced, open domain chatbots which perform good enough for the context understanding and provide appropriate responses which the user may find helpful to drive the conversation.

Additionally, as a part of Goal 2, the assistance strip will consist of the messages that are generated by the AdvisorBot which would be able to provide better conversational assistance.

While the users are having conversations, there would be prompts to gather information about how the system is performing. These prompts would be simple yes / no questions like:

1. How is the assistant suggestion bot performing?
2. Is the conversation satisfactory?

### Post-chat Questionnaire

After every conversation, the subjects will be asked to rate the conversation and asked a few questions about conversational assistance and research goals. This is beneficial for understanding the linguistic parameters that are essential for achieving a successful conversation. This would later help to create the AdvisorBot.

Some of the questions that can be asked are:

1. What were the good aspects while having the conversations?
2. What were the things that users felt odd or bizarre or uncomfortable while having the conversation?
3. Suggestions to improve the user experience.

## Data Privacy and Data Gathering

The data gathered from the subjects will be open sourced for future research purposes. However, the personal information of the user will remain private. The collected data will be retained throughout the research. The data gathered consist primarily of the conversations that the subjects have, their demographic information and their feedback based upon their experience in using the platform and conversational assistant aid.

Since the users are needed to fill up the demographic information prior to signing up, the demographic information will be linked to the user’s identity. The identity information will be retained only to prevent the returning users from filling out the demographic information again.

The demographic information and the post-chat questionnaire will remain anonymous. The user’s personal information will not be disclosed or used for the research purposes and the users are therefore advised not to disclose any personal information over the chats either. The user’s consent is required prior to signing up on the platform.

Publication of the data will be deidentified to mask the user’s identities.

## Open Source Packages

The chatbot interaction framework will be constructed using open source packages to protect the subject’s data from being provided anywhere. The system would be constructed using Python, HTML5, CSS, Django and Flask frameworks. The main components which users would require to interact with is the assistive conversational feedback which is built by creating a chatbot ensemble. The open source chatbots used are:

Microsoft DialoGPT

Facebook Blenderbot

Additional chatbots may be deployed as and when needed but all would be open sourced.

### User Experience

The subjects would be provided with a rich user experience that would keep the users engaged to use the platform and therefore generate the data needed for the research.

Some measures that can help in building the community to engage users are:

1. “Karma Points” that users get when using the application and suggesting feedback.
2. Trophies for
   1. Having engaging conversations over time frames like 5mins, 10mins, and more
   2. Sending a certain number of messages 1000, 5000, and more.
   3. Conversating a certain number of times like 10 conversations, 15, 30 and more.
3. Users can convert their trophies to awards.
4. Awards that users can give to chatbot’s suggestions if the suggestion is accurate for complicated topics.

### User’s Perspective

The user will be provided with a simple UI and would be interacting with another human or a chatbot. The users would be interacting with each other like regular humans and discuss generic topics. This would help in analyzing open-ended conversational chatbots and if the suggestive inputs help in driving the conversation forward.

Some of the challenges that users may face are:

1. Chatbots are not able to understand the conversational flow and would deviate off topic.
2. Chatbots cannot understand sentences and would generate noisy responses which may seem gibberish to the users.
3. The suggestive feedback may not provide appropriate responses.
4. Difficult to maintain the conversation and users may get bored.
5. Chatbots using or suggesting harsh language and inappropriate responses.
6. Users may find the UI complicated.

# Stage 1: Linguistic Analysis

## Phase 1: Data Collection

The data collection phase is the initial phase which consists of setting up the environment that consists of the existing open domain chatbots as described in the Chatbot Interaction Framework section.

The data collected would consist of the demographic information of the subjects, the conversations that they have and the anonymous feedback that the subjects provide essential for the research. The user’s personal information will not be used for any manner

## Phase 2: Data Analysis

The gathered data will be analyzed to find out the essential linguistic parameters that can provide the user with a sense of successful conversation.

The chats gathered can also be used to train an advisor bot based upon the existing ensemble of open source chatbots being used for providing the conversational assistance.

## Phase 3: Hypothesis Testing (on new data)

Obtain hypothesis of essential parameters of having a successful conversation that provides the user with a sense of satisfaction and design test cases over the conversational data obtained in Phase 2 for critically analyzing the hypothesis.

# Stage 2: AdvisorBot

## Phase 1: AdvisorBot Design

Extract essential information from Stage 1 that can help in fine-tuning the parameters required for open domain chatbots.

Research natural language processing algorithms and techniques that can be used to build the AdvisorBot that can provide better conversational assistance.

## Phase 2: Implementation and software testing

Deploy the AdvisorBot over in the Chatbot Interaction framework for gathering more data similar to the Stage 1 methods except here the conversational assistance would be provided by the AdvisorBot.

## Phase 3: User study (test if it works)

Analyze the gathered data and test if the AdvisorBot was able to provide better assistance and the users are more satisfied by getting the assistance.

# Comprehensive list of the data gathered from the users

The data would be collected upon getting the user’s informed consent and would be deidentified prior to release. The data collected is split into two types (one being released and the other will not be released). The data that is not being released will be stored into a separate database. It consists of unique numeric UserID and login information (user’s email address and password) so that users may return to use the app and therefore won’t need to fill the demographic information again.

The second database will consist of the data being collected, which consists of three components: demographic information (asked only once throughout the process), in-chat data, post-chat questionnaire. This data will be linked to the numeric UserID and therefore helping in deidentifying reasons prior to the release.

## Demographic Information

The demographic information will be asked only once upon signing up. The questions asked here include:

1. Age in years
2. Gender Identity
   1. Male/Man
   2. Female/Woman
   3. Trans male/Trans man
   4. Trans female/Trans woman
   5. Genderqueer/Gender non-conforming/Gender non-binary
   6. A gender identity not listed here. Please specify
3. Race / Ethnicity
   1. Hispanic/Latino
   2. Black or African American, Non-Hispanic
   3. White, Non-Hispanic
   4. American Indian or Alaska Native, Non-Hispanic
   5. Asian, Non-Hispanic
   6. Native Hawaiian or other Pacific Islander, Non-Hispanic
   7. Two or more races, Non-Hispanic
   8. Race and/or Ethnicity Unknown
   9. Prefer not to answer
4. Native Language
   1. English
   2. Chinese – Mandarin
   3. Chinese – Cantonese
   4. French
   5. German
   6. Italian
   7. Korean
   8. Russian
   9. Spanish
   10. Vietnamese
   11. Hindi
   12. Portuguese
   13. Arabic
   14. Others – Specify
5. Nationality
   1. List of countries
6. Education
   1. Some high school
   2. High school diploma or equivalent
   3. Post High School Vocational training
   4. Some College or Associate's degree
   5. Bachelor's degree
   6. Master's degree
   7. Doctorate degree
7. Field of Education
   1. Natural and Physical Sciences (E.g. Mathematical, Astronomy, Chemical, Earth, Biological, Other Natural and Physical Sciences)
   2. Information Technology (E.g. Computer Science, Information Systems, Other Information Technology)
   3. Engineering and Related Technologies (E.g. Aeronautics, Manufacturing, Food Technology, Materials Science, Plant and Machine Maintenance)
   4. Architecture and Building (E.g. Architecture and Urban Environment, Building)
   5. Agriculture, Environmental and Related Studies (E.g. Crop Production, Animal Production and Management, Environmental Impact and Assessment)
   6. Health (E.g. Disease Processes and Mechanisms, Restoration and Maintenance of Health, Diagnosis, Principles and Practices of Public Health)
   7. Education (E.g. Curriculum Development, Processes of Learning and Skill Acquisition, Teaching Methods)
   8. Management and Commerce (E.g. Administration, Human Resources, Sales, Marketing, Financial Management, Human Behaviour and Time Management)
   9. Society and Culture (E.g. Belief and Value Systems, Cultural Expression, Human Development, Politics, Social Organisation & Research)
   10. Creative Arts (E.g. Performing Arts, Visual Arts and Crafts, Graphic and Design Studies, Communication and Media Studies, Other Creative Arts)
   11. Food, Hospitality and Personal Services (E.g. Food and Hospitality, Personal Services, Beauty Care, Hair Cutting & Styling, Housekeeping)
   12. Mixed Field Programs (E.g. General Education, Social & Employment Skills, Literacy & Numeracy Skills, Social & Workplace Relationships)
8. Marital Status
   1. Never married
   2. Married
   3. Widowed
   4. Divorced
   5. Separated
9. Employment Status
   1. Employed Full-Time
   2. Employed Part-Time
   3. Student
10. Work Industry
    1. Computer and Information Systems (E.g. Computer Science, Information Systems, Other Information Technology)
    2. Agriculture, Forestry, Fishing and Hunting
    3. Mining, Quarrying, and Oil and Gas Extraction
    4. Utilities (E.g. Electric Power Generation, Transmission, Distribution, Natural Gas Distribution, Water, Sewage, Irrigation)
    5. Construction
    6. Manufacturing
    7. Wholesale Trade
    8. Retail Trade
    9. Transportation and Warehousing (E.g. Urban Transit Systems, Mixed Mode Transit Systems, School and Employee Bus Transportation)
    10. Information (E.g. Publisher, Motion Picture, Telecommunications, Data Processing, Hosting, News Syndicates, Libraries and Archives)
    11. Finance and Insurance
    12. Real Estate and Rental and Leasing
    13. Professional, Scientific, and Technical Services (E.g. Legal Services, Offices of Lawyers, Tax Preparation Services, Industrial Design Services)
    14. Management of Companies and Enterprises (E.g. Offices of Bank Holding Companies, Management of Companies and Enterprises)
    15. Administrative Support, Waste Management, Remediation Services (E.g. Employment, Support Services, Private Mail Centers, Telemarketing Bureaus)
    16. Educational Services
    17. Health Care and Social Assistance
    18. Arts, Entertainment, and Recreation
    19. Accommodation and Food Services (E.g. Hotels, Casinos, Caterers, Restaurants, Drinking Places (Alcoholic Beverages))
    20. Public Administration (E.g. Executive Offices, Legislative Bodies, Justice, Public Order, National Security, International Affairs)
    21. Other Services (E.g. Automotive & Electronics Repair & Maintainence, Personal Care Services, Cemeteries, Pet Care, Parking Lots)
11. Have you been diagnosed with any disability or impairment?
    1. Yes; Specify if yes
    2. No
12. How were you recruited for this program?
    1. Events & Activities at Illinois Tech
    2. Referred by a friend or a colleague
    3. Contacted by an associate working on this application
    4. Search Engine
    5. Social Media
    6. Blog / Publication

## In-Chat Data

1. The messages sent and received by the user
2. Whether the user used the chat advice from the suggestive feed (Yes / No)
3. Performance of the assistant suggestions (Good / Bad)
4. Performance of the conversation that is going on (Good / Bad)

These questions would be asked to the user repeatedly to understand the user’s interaction with the other subject and the AdvisorBot.

## Post-Chat Questionnaire

After every conversation that the user participates in, the user will be asked to fill out the post-chat questionnaire. These questions will require user’s text inputs. The questions asked include:

1. Numeric Ratings Questions (How much do you agree / disagree with these statements)
   1. The conversation was comfortable and flowed well.
   2. There were times when I felt uncomfortable during conversation.
   3. My conversational partner understood me very well.
   4. I understood my conversational partner very well.
   5. The conversational assistance was helpful.
   6. The conversational assistance was distracting or annoying.
   7. The conversational assistance was able to understand the context and was able to provide accurate suggestions.
   8. The conversational assistance will help in creating and maintaining the flow in the conversation.
   9. I enjoyed the overall experience.
   10. I would recommend someone to participate in this research study.
2. Text-input Questions
   1. What were the best parts of the conversations?
   2. What aspects of the conversation were uncomfortable or strange?
   3. Suggestions to improve the user experience.

# Potential Risks Associated

Since the application is online, the direct risks associated with the subject’s health is minimal. Some other risks associated while using the application are:

1. Subjects may feel uncomfortable regarding privacy aspects.
2. Subjects may feel exposed about disability or impairment.
3. Subjects may feel uncomfortable or inhibited like they cannot talk openly since the chats are being recorded.
4. Subjects may feel irritated by the questionnaires.
5. Subjects may feel irritated about the suggestions.
6. Subjects may feel that the suggestions are poor and irrelevant.
7. Subjects may feel that the suggestions are inappropriate and can cause discomfort.
8. Subjects may feel afraid that the conversation is being driven by the chatbot instead.
9. Subjects may feel uncomfortable about Artificial Intelligence taking over humans.