

# Chatbots As Meeting Stand-In: Enhancing Remote Work Productivity

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## Abstract

The COVID-19 pandemic has led to a significant increase in remote work, resulting in a higher number of online meetings and causing stress on team members. While remote work provides flexibility, it has also led to an increased dependence on online meetings. A recent study found that 70% of meetings keep employees from doing productive work (Benjamin Laker, n.d.). Excessive meetings have been shown to negatively impact productivity and cause frustration among employees (DEEB, n.d.).

One potential solution to this problem is to develop a chatbot that can substitute team members who are unable to attend meetings, providing answers to common questions and updates on project status.

This paper recognizes that while the use of technology to replicate human presence in meetings is innovative, its applicability is contingent upon the specific nature of interactions. The research underscores the potential advantages of utilizing meeting stand-in chatbots for routine information dissemination and status updates, presenting a case for reducing stress and enhancing work-life balance among employees. By freeing valuable time from repetitive meetings, employees can redirect their efforts toward tasks that demand their unique expertise, potentially fostering heightened job satisfaction and overall productivity.

By investigating both the "build" and "buy" approaches to implement such chatbots, the paper provides insights into the decision-making process for organizations seeking to leverage this technology. Furthermore, the analysis highlights the implications of introducing chatbot representation in meetings, including factors like context understanding, communication style, and technological limitations.

The paper also addresses key considerations for the successful implementation of a chatbot, such as regular updates with accurate information, and trained to respond to a wide range of questions. The design flow of implementing a chatbot is also discussed.

## Biography

Kavitha is a senior lead with over 20 plus years of experience in the field of software quality assurance and project management. She is a highly motivated professional who is passionate about quality and processes, and has worked extensively in improving the product quality of various products in Tektronix Inc. She has a strong background in developing and implementing quality assurance processes, procedures and methodologies,

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# 1 Introduction

In a traditional office setting, face-to-face conversations often takes place by simply walking over to a colleague's cubicle. However, with the work-from-home arrangement, even minor discussions necessitated scheduling online meetings. This increased frequency of meetings has several drawbacks, including a potential decline in productivity and negative impacts on individuals' well-being.

It is important to acknowledge that not all meetings require the physical presence of every participant, and exploring innovative alternatives can be beneficial.

By utilizing Artificial Intelligence (AI) for meeting representation, we can address some of the challenges posed by excessive meetings. AI-powered solutions can automate certain tasks, provide real-time assistance, and streamline communication during meetings. This reduces the need to attend unnecessary meetings and allows participants to focus on essential discussions, thus enhancing productivity and alleviating the burden on individuals.

The subsequent section of the paper explores the significance of meetings and provides insights into leveraging an AI-powered chatbot as a representation in meetings.

## 2 "Meeting Overload: Impact on Productivity"

### 2.1 Why do we require Meetings?

1. Understand the requirements during project requirement phase.
2. Planning meetings to discuss on the project plan and timelines.
3. Discuss on design details during design phase.
4. Understand the testing aspects during testing phase.
5. Understand the progress of the project.
6. Discuss on issues and defects.
7. Discuss on learnings to take it forward.
8. Project closure meetings

The above are high level meetings that are inevitable. Hence, we can see that, there are good many advantages in scheduling and attending meetings. It is up to the team members to understand and plan for the meetings that they need to attend or alternatively find out innovative ways to attend the meetings.

### 2.2 Meeting Calendar

Consider the typical calendar day depicted in Figure 1 below. This day is packed with meeting requests, commencing in the morning, and extending into the late evening hours. Between these scheduled meetings, there exists a valuable gap of ~ 2.0 hrs. (excluding the designated lunch break) that can be optimally utilized for project-related tasks. Hence optimization in attending meetings plays a key role.

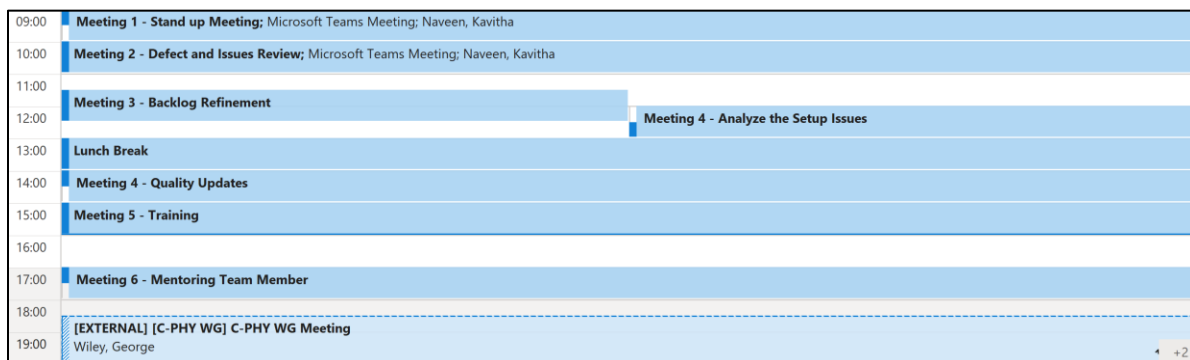


Figure 1: Meeting Calendar

## 2.3 Root Causes of Ineffective Meetings

The top reasons why meetings are ineffective includes the following:

### 2.3.1 Time lost in meetings.

Usually for every meeting there are few team members who join late and some team members who extend their conversations and hence meetings get extended. For example, as per the Table 1 you can see that if we consider any three meetings in a day, due to the start time and end time, the time lost is around 400 minutes considering typically a team size of 5 to 7 team members.

Meeting Details	Actual Meeting Time	Start Time	End Time	Team Size	Extended Time (min.)
Meeting 1	9:30 AM to 10:00 AM	9:35 AM	10:10 AM	6	90
Meeting 2	2:30 PM to 3:30 PM	2:35 PM	3:45 PM	5	100
Meeting 3	5:00 PM to 5:30 PM	5:00 PM	6:00 PM	7	210
<b>Time lost due to Meeting Extension</b>					
Per day due to 3 Meetings	400 min <sup>Note 1</sup>				
Per week assuming 5 working days/week	2,000 min <sup>Note 2</sup>				
Per month assuming 20 working days/month	40,000 min <sup>Note 3</sup>				
Per Year assuming 12 months	8,000 hrs <sup>Note 4</sup>				
Total cost to the company assuming 40\$/hr.	3,20,000 \$ <sup>Note 5</sup>				
Note 1: (90 + 100 + 210) min. Note 2: (400min x 5days) min. Note 3: (2,000 * 20) min. Note 4: (40,000 * 12) /60 hrs. Note 5: (8000 hrs * 40 \$)					

Table 1: Time lost in meetings.

### 2.3.2 Efficiency of Meetings

A study by the University of North Carolina (source [Stop the Meeting Madness \(hbr.org\)](https://hbr.org/stop-the-meeting-madness)) surveyed 182 senior managers in different industries about their meetings and the results showed that:

- 71% of them found their meetings to be unproductive and inefficient.
- 65% said that meetings keep them from completing their own work.

Another limitation of meetings is irritations caused to an employee due to various reasons as given in Figure 2.

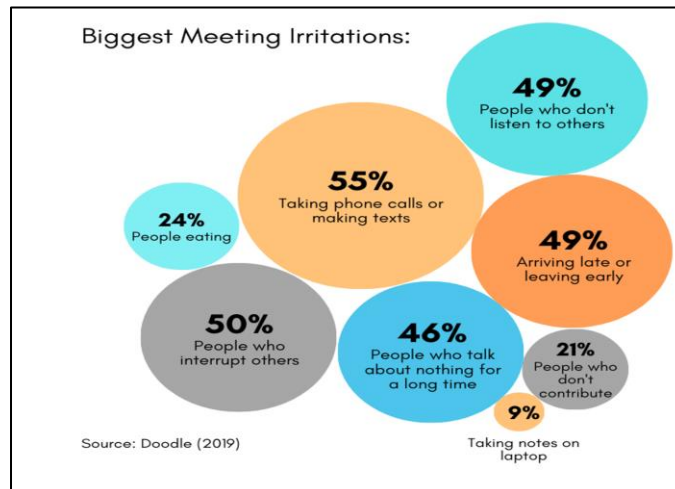


Figure 2: Meeting Irritations

### 2.3.3 Consequences of Ineffective Meetings

- 44%: 'Not enough time to do the rest of my work.'
- 43%: 'Unclear actions leading to confusion.'
- 38%: 'Bad organization results in a loss of focus on projects.'
- 31%: 'Irrelevant attendees slows down progress.'
- 26%: 'Inefficient processes weaken client/supplier relationships.'

Source : [Min. \(Wasted\) of Meeting: 50 Shocking Meeting Statistics | BOOQED Blog](#)

## 3 Chatbot as Meeting Stand-In

In Section 2, we discussed the benefits of effective meetings, as well as the reasons why some meetings can be ineffective, resulting in costs to the company. Let us examine the problem and the solution that the meeting stand-in chatbot provides, as specified in Figure 3

### 3.1 What is the problem and how can Chatbots help us as Meeting Stand-In?

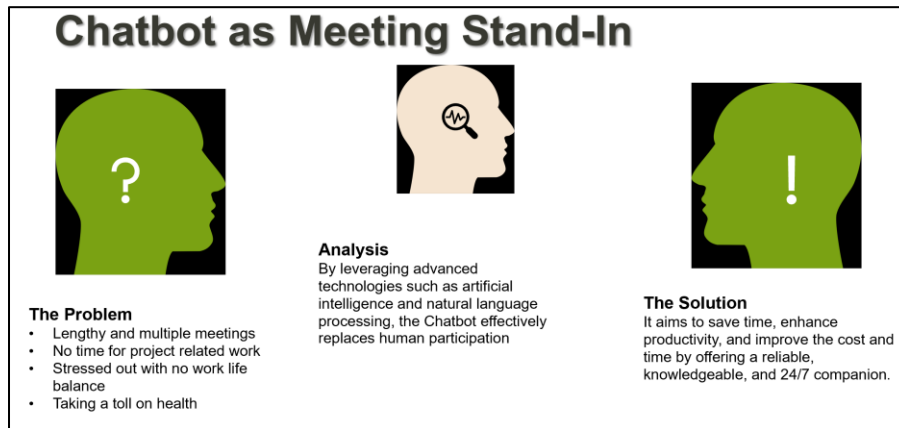


Figure 3: Problem and Solution

Let us take a deep dive on the advantages of having chatbots as meeting stand-in in the below sections.

### 3.2 Leverage the benefits of Chatbot as Meeting Stand-in

#### 3.2.1 Absence Management Stand-In:

If a participant is unable to attend a meeting due to scheduling conflicts or other reasons, the meeting stand-in chatbot can step in and represent the person. It can provide pre-determined responses to common questions or address specific topics on behalf of the absent participant. This ensures that important information is still shared and discussed, even in their absence. If the organizer wants further updates, notifications can be sent to the concerned team member so that he responds accordingly. This helps to save time for both the organizer and the participant.

#### 3.2.2 Knowledge Base Stand-In

Meeting stand-in chatbot can be integrated with an organization's knowledge base or documentation system. When a question is asked during a meeting, the meeting stand-in chatbot can search the

knowledge base for relevant information and provide accurate answers. This eliminates the need for participants to interrupt the meeting to search for information themselves.

### 3.2.3 Expert Assistance – Stand-In

In meetings where subject matter experts are required but unavailable, meeting stand-in chatbot act as an expert. It can possess a deep understanding of the topic at hand and provide detailed and accurate responses to questions or concerns raised during the meeting.

Additionally meeting stand-in chatbot can provide valuable assistance to enhance the overall meeting experience. It can offer features such as automated meeting scheduling and real-time information retrieval. These chatbots can integrate seamlessly with popular messaging platforms, allowing participants to interact with them effortlessly.

## 4 Meeting Stand-In Chatbot Design Flow

The meeting stand-in chatbot's design flow as specified in Figure 4 is accurately crafted to seamlessly integrate within the meeting ecosystem while providing a user-friendly experience. The journey begins with the meeting stand-in chatbot's integration with calendar applications to ensure automatic attendance and participation. Once in the meeting, the meeting stand-in chatbot analyzes spoken content and context, enabling it to offer insightful contributions and responses. Users can also interact with the meeting stand-in chatbot in real time, either through voice or text inputs, allowing for dynamic engagement. To maintain authenticity, the meeting stand-in chatbot employs natural language processing to emulate human-like conversations. This comprehensive design flow not only empowers the meeting stand-in chatbot to fulfill its stand-in role effectively but also elevates meeting efficiency and collaboration through its intuitive and adaptable interface.

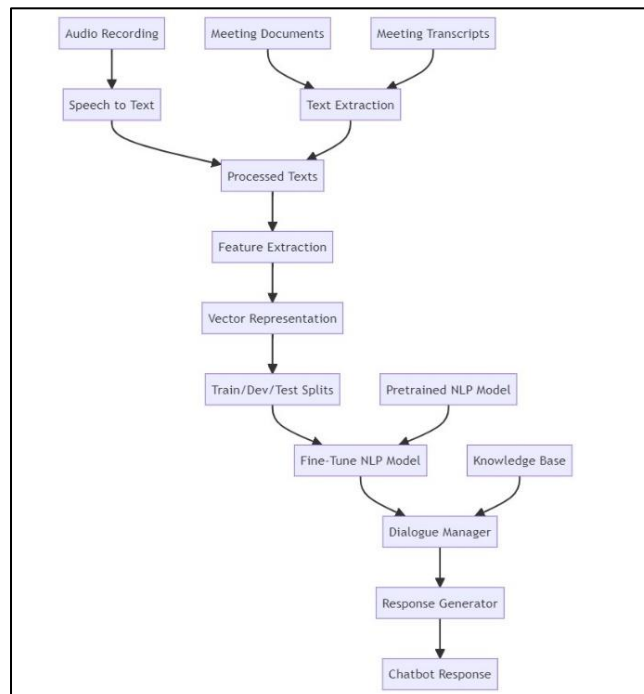


Figure 4: Meeting stand-in chatbot design flow

The meeting stand-in chatbot utilizes a standard natural language processing (NLP) architecture consisting of the following components:

**Data Collection:** Meeting transcripts, documents, presentations, and other relevant data needs to be collected to train the chatbot. Audio recordings may be transcribed to text using speech recognition.

**Preprocessing:** The meeting training data is cleaned and normalized. This includes speech to text conversion, text extraction, spelling correction, removing punctuation, converting to lowercase, etc.

**Feature extraction:** This includes the process of converting data into a set of numerical features or representations that can be used as input for machine learning models or algorithms.

**Model Training:** It refers to the process of fine-tuning a pretrained NLP model such as the DistilBERT model developed by Hugging Face or LLaMA (Large Language Model Meta AI) to recognize patterns, make predictions, or perform specific tasks based on the model's specific data set.

**Knowledge Base:** A database of key information relevant to meetings such as participants, agenda, past minutes, and documents. This provides facts/data for the chatbot.

**Dialogue Manager:** This component handles the chatbot's conversational capabilities and flow. It interprets user questions, retrieves information from the knowledge base, and determines responses.

**Response Generator:** Takes the output from the dialogue manager and converts it into natural language responses.

**Human Expert Involvement:** The chatbot is designed to ask for clarification when needed or route complex questions to a human expert. This ensures that users receive accurate and reliable information even in intricate scenarios. Meeting data needs to be anonymized wherever possible to address privacy concerns.

**Testing and Reliability:** Extensive testing needs to be conducted to ensure the chatbot's performance is dependable and secure.

Example dialogue:

Participant: "Can you give me an update on the project's timeline?"

Chatbot: "Sure! As of the latest update, the project timeline has been extended by two weeks due to unexpected delays in the development phase. We are now targeting completion by the end of next month."

Participant: "Can you share the presentation from the last meeting?"

Chatbot: "Of course! I've just sent you the link to download the presentation slides from the last meeting."

#### **4.1 Meeting Stand-in Chatbot - Daily Stand-up Sequence Flow Diagram**

The sequence flow diagram in Figure 5 depicts the steps involved in a daily standup meeting using a meeting stand-in chatbot. The user receives a meeting invite for the daily standup and clicks on the custom outlook add-in. The meeting stand-in chatbot asks for permission to join the meeting on behalf of the user. If the user allows the meeting stand-in chatbot to join, in preparedness for the meeting, it asks the user standard questions for the daily standup. The user can answer the questions and add additional information to enable the chatbot to participate in the meeting and represent the user. The chatbot then joins the meeting programmatically and answers the questions on behalf of the user. If the meeting stand-in chatbot is unable to answer a question, it sends an email to the user with the question.

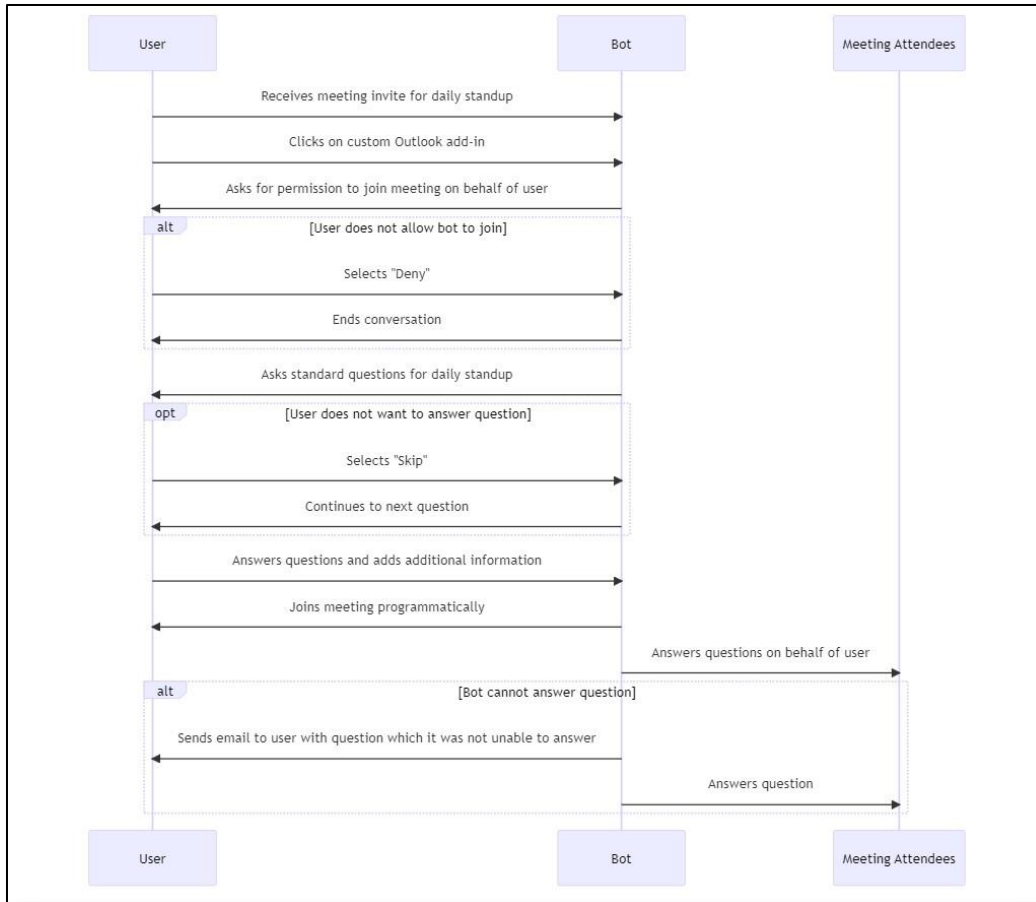


Figure 5: Meeting stand-in chatbot daily stand-up meeting

The sequence flow diagram includes the following key points:

- The meeting stand-in chatbot automates the process of collecting updates from team members, tracking progress, and sharing information with the team.
- The meeting stand-in chatbot provides a central repository for all standup updates, which improves accountability and transparency.
- The meeting stand-in chatbot can answer questions on behalf of the user, which frees up the user's time to focus on their work.

## 5 Meeting Stand-In Chatbot - Return on Investment (ROI)

Calculating the ROI for implementing a chatbot strategy involves a comprehensive evaluation of both building and buying options. For the 'build' approach, the costs associated with development, design, testing, and ongoing maintenance needs to be considered. These costs are balanced against the potential benefits such as increased efficiency, improved customer service, and reduced operational expenses. Similarly, for the 'buy' approach, the initial investment in purchasing a pre-built chatbot solution needs to be weighed against the anticipated gains. Comparing the two strategies involves assessing the projected ROI for each. By quantifying both the costs and benefits for building and buying a chatbot as given in Table 2, businesses can make an informed decision based on the potential ROI and align it with their strategic goals and resources. The ROI can be calculated using the formula  $ROI = (Current\ Value\ of\ Investment - Cost\ of\ Investment) / Cost\ of\ Investment$ .

Factor	Build Chatbot	Buy Chatbot
Price	Can be expensive - Refer Note 1	More affordable Refer Table 3
Time to develop	Can take longer	Faster
Control	More control	Less control
Adaptability	Offers higher adaptability	Provides limited adaptability
Protection	Can provide more protection	May provide less protection
Scalability	Possibly more scalable	May have limited scalability
Input Parameters	Context size needs to be decided before the development begins and switching would involve design change	Switching between models with different context sizes is relatively straightforward
Usable Service Life	Investment in fine-tuning opensource base models, which can demand thousands of hours of computation on specialized GPUs	Utilizing 3rd party APIs, like the OpenAI API, hinges on API availability and the provider's commitment to updates.

Table 2: Meeting stand-in chatbot build and buy options.

Note 1: Cloud GPU providers like Lambda Labs offer options such as the A100 (40 GB PCIe) at \$1.1 per hour and the 1x H100 at \$1.99 per hour.

## 5.1 Buy Chatbot

In analyzing the total cost for purchasing a chatbot, it's essential to consider the procurement of 3rd party API (Application Programmatic Interface) access and its integration into the company's platform for inference. The cost is contingent upon performance and context size. Context size refers to the input scale usable for the model. Notably, pricing structures often revolve around tokens in input and output data. You can think of tokens as pieces of words, where 1,000 tokens are about 750 words. Below in Table 3 is a comparative pricing table for some of the most popular API available in the market:

Model Name	Context Size (tokens)	Input	Output
GPT 4	8K	\$0.03 / 1K tokens	\$0.06 / 1K tokens
GPT 4	32K	\$0.06 / 1K tokens	\$0.12 / 1K tokens
GPT-3.5 Turbo	4K	\$0.0015 / 1K tokens	\$0.002 / 1K tokens
GPT-3.5 Turbo	16K	\$0.003 / 1K tokens	\$0.004 / 1K tokens

Table 3: Meetings stand-in chatbot – Buy API Cost

## 5.2 Challenges Affecting ROI for Meeting Stand-In Chatbots

**Error Risk** - In-house chatbots may introduce transcription errors due to language complexities, undermining accuracy, and ROI.

**Limited Collaboration** - Self-built chatbots can't actively engage, hampering collaborative meeting recording and accuracy.

**Contextual Limits** - In-house chatbots might miss discussion context, leading to incomplete summaries and reduced value.

Here are some additional factors to consider when making the build vs. buy chat decision:

- The size and complexity of the business.
- The budget available for the chatbot project.
- The technical expertise of the in-house team.
- The urgency of the need for a chatbot.
- The long-term goals for the chatbot.



## 6 Conclusion

In conclusion, this paper demonstrates the feasibility of using chatbots to stand in for team members at meetings, potentially providing numerous benefits for remote workers and organizations. While the idea of using technology to represent individuals in meetings is innovative and could potentially streamline communication, it's crucial to recognize its applicability.

Nevertheless, in specific scenarios where the focus is on information dissemination or status updates, a meeting stand-in chatbot can prove beneficial. By allowing the chatbot to handle routine status-related meetings, employees could experience reduced stress and a better work-life balance. This approach can free employees from repetitive meetings, enabling them to allocate more time to tasks that require their unique skills and expertise. This, in turn, could contribute to higher job satisfaction and increased productivity.

The meeting stand-in chatbot is a revolutionary solution poised to transform the way businesses conduct meetings. This innovative technology harnesses the power of artificial intelligence to seamlessly simulate a human presence, enabling the chatbot to engage in meetings, presentations, and discussions on behalf of team members. By mimicking natural language interactions, the chatbot facilitates real-time communication, offers insights, and responds to inquiries just as an actual participant would. Its potential to reduce scheduling conflicts, minimize participant overload, and optimize time allocation underscores its significance in the modern corporate landscape. As organizations continue to embrace digital transformation, this chatbot stands as a testament to the limitless possibilities AI brings to redefining how we engage in professional discourse.

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