1. The Muninn System: The Rebirth of Memory
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2. Abstract
   a. Amnesia, dementia, and not being able to say goodbye to a dying loved one. What do these three have in common? Memory. Memory defines everything in our lives. Our past determines our future. Now imagine an artificial backup of our memories that we could access at any time in the form of a trustworthy friend. This friend could help patients with memory loss rediscover who they are, and give everyone a chance to talk to their ancestors, offering people a second chance at refinding themselves and at saying goodbye. That is what I aim to do, using a user-defined artificial intelligence platform. First, I will develop a website where the user can fill out a form and upload a video. Then I can use Amazon Web Services (AWS) to process the form answers and parse it into a JSON file. The video will be processed by Descript to extract and generate a voice for the agent. Then AWS can combine the JSON file and the synthesized voice with a standard machine learning model to create one single chat agent. This agent will then be accessed to talk to through SMS and phone calls using the Twilio API and through a password protected web portal hosted on Netlify. By allowing the user to generate an agent based off of their own life, my project allows for a more personal type of therapy and a more personal process of AI development.

3. Idea
a. Problem

i. Memory Loss

1. Approximately 6.62 million people suffer from Dissociative Amnesia in the US alone (Hull, 2020, para. 2). Around 5.8 million people have Alzheimer's disease, a form of dementia, in the US (What is Alzheimer’s Disease?, 2020, para. 5). Both of these diseases have memory loss symptoms, and require an augmented type of communication, where sentences must be formatted in a simple and gentle manner (Dementia, 2019, para. 20). Furthermore, about 16 million people in the United States have age induced memory loss (Small, 2002, para. 4). This means that altogether, around 28 million people struggle with the recollection of their own lives. In this arena, the Muninn System aims to help these people remember themselves and their loved ones in a safe and tender manner.

ii. Grief

1. Figure 1

   a. Number of Deaths Per Year, World

   ![Number of Deaths Per Year, World](image)
c. Note. By Hannah Ritchie, a graph of the number of deaths per year up to 2019 and a graph of the projected number of deaths until the end of the century.

2. As shown in Figure 1, the death rate has recently started to rise at an increasingly rapid rate (Ritchie, 2019, Figure 4). 2020 especially has had a great impact on this rate, due to the Coronavirus, with the US Census Bureau reporting upwards of 3 million deaths just this year; for context, the Census Bureau didn't expect to reach this number until the next decade (Preliminary US Death Statistics, 2020, para. 5). From all of this data, it can be inferred that the amount of grief people feel, especially in the coming years, will be tremendous. A good way to minimize the impact of the grief is to say goodbye to the dying person (Weir, 2020, para. 3). However, especially in our new normal, not everyone gets that chance. Not being able to say goodbye, missing the final moments of a loved one’s life, can cause numerous physical and mental health issues such as Prolonged Grief Disorder, Hyperactivity, Depression, and Exhaustion (Weir, 2020, para. 8; My Friend Died). This is what the Muninn System aims to counter.

b. Current Solutions
i. Memory Loss

1. While some memory loss is reversible (like memory loss due to alcoholism or minor head injuries), not all memories are restorable (Memory Loss, 2020, para. 15). Currently, for non-reversible memory loss, patients can at most only manage their symptoms. For severe cases, a family member or friend may need to help patients remember (Dementia, 2019, para. 20). However, this can become inefficient because the helpers themselves may not have certain information or memories, or may simply just misremember or misinterpret information.

ii. Grief

1. Right now, there is really no way to get a second chance of saying goodbye that is currently in production. Granted, grief counseling and therapy exists in order to help people to cope with loss, there’s no notable technology that currently exists that allows people to have a second chance to talk to the deceased.

c. Proposed Solution

i. The Muninn System allows users to generate personalized artificial intelligence agents based on their own memories and experiences. For patients with memory loss, an assistance mode can be triggered (these are created while the user is in a healthy state, to
be used in the event that they suffer from memory loss). An assistance-enabled agent will talk slower and in a simpler fashion with a standard voice so that the patient can understand the agent without being confused as to why it sounds like them, and will also retain the patient’s memories such that it can tell the patient about themself and slowly remind them of themselves. An assistance-disabled agent would primarily be used for grief purposes, based off of the deceased, and talked to by the grieving. Because there is currently no way to replicate oneself in a digital form yet, this would revolutionize memory loss treatment and grief therapy. A few applications, like Replika, already exist that allow you to create simple chatbots. However, these do not have the user’s memories, vocabulary, or voice, and these are the distinguishing features. However, this project does. The Muninn System allows users to create essentially virtual and realistic artificial intelligence backups of themselves, that can be accessed at any time by anyone they trust.

4. Plan

   a. Approach

      i. Assistance Enabled (for memory loss patients)

         1. Figure 2

            a. User Control Flow for Assistance-Enabled Agents
c. Note. A flowchart of services that run after a user fills out a form to create an assistance-enabled agent.

2. As outlined in Fig. 2, the user initializes the process by filling out a web form hosted on Netlify. Once the form is submitted, a Lambda Function is triggered that parses the form into a JSON file which is then sent to an AWS EC2 instance that couples it with the Standard Agent template. The EC2 instance then initializes another EC2 instance that integrates the new agent with Twilio and creates a password protected web portal using a Python Flask template. Once this EC2 instance is set up, it sends out an email to the user with all the needed information and credentials to access the agent. All of these technologies are used and integrated with each other to create powerful tools already, so the combination of these technologies should not be much of a hassle.

ii. Assistance Disabled

1. Figure 3
b. *Note.* A flowchart of services that run after a user fills out a form to create an assistance-disabled agent.


2. As outlined in *Fig. 3*, the process of creating an assistance-disabled agent is much the same as an assistance-enabled one, with the exception of voice synthesis. For this, a video will be uploaded by the user of themselves speaking, and Descript will create a voice for the agent that is later integrated into the agent. From that point, generation is the same process as shown in *Fig. 2*.

b. Resources

i. The resources I will need for this project is an AWS subscription, a Netlify account, a Descript account, and a Twilio API Key. I already have a Netlify account, and a Descript account is free. AWS also has a 12 month free trial. This leaves Twilio, which is what the $1,000 dollar grant will mostly be used for. As for mentorship, the THINK mentors will be the only people helping with this project.

c. Goals
i. The entire process of agent creation should take 30-60 seconds depending on its assistance mode configuration.

ii. The system must be usable, subjectively determined by user feedback, and accurate, determined by testing each agent for appropriate responses.

d. Risks

i. If Descript proves to be unusable, it can be replaced with AWS Polly, Common Voice, or the Real Time Voice Cloning repository.

ii. If I cannot parse the form with Lambda, then I can use Babel to parse it and then upload it directly without a Lambda.

iii. If the Twilio API doesn’t allow many integrations with one key, I can generate a unique key for each agent using EC2, use an enterprise solution from Twilio, or utilize another communications platform.

iv. If EC2 instances cannot create other instances, I can use AWS S3 to host web portals, or drop web portals altogether as they can already be accessed through SMS.

e. Timeline

i. Web Form

1. Creation of the Web Form with a Lambda Function that can parse the form into a JSON file (estimated time: 1 week).

ii. Standard Model Creation

1. Creation of the Standard Agent, which can be coupled with JSON files to create agents (1 week)
iii. AWS Integration and Voice Synthesis
   1. Using EC2 to combine voices, JSON files, and the Standard Agent (1.5 months).

iv. Communications Integrations
   1. Integrating agents with Twilio and Web Portals (1 month).

v. Calibration and Testing
   1. Testing the agents to make sure the system reaches and exceeds all goals (3 weeks).

f. Current Progress
   i. I already have a working model Standard Agent.
   ii. I also have a web form template already. All that is needed is to connect it to a Lambda Function (refer to Fig. 2).

g. Need for Funding and Mentorship
   i. The funding, as illustrated in the Resources section, will be used mostly for Twilio, with some remaining a Netlify Pro account if needed. The mentorship is the truly beneficial part. With the Think team mentoring me on how to streamline the project, I will be able to consolidate all of my integrations into one coherent and usable system.

h. Project Budget

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
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<tbody>
<tr>
<td>750 Hours EC2 per month</td>
<td>Free</td>
</tr>
<tr>
<td>1 Million Lambda Requests per month</td>
<td>Free</td>
</tr>
<tr>
<td>Descript</td>
<td>Free</td>
</tr>
<tr>
<td>Netlify</td>
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</tr>
<tr>
<td>---------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Twilio per message</td>
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<tr>
<td>Twilio per call per minute</td>
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<tr>
<td>Netlify Pro (in case free tier cannot make many Lambda Requests)</td>
<td>~100.00</td>
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i. The expected pricing amounts to around the range of $300 as a worst case and $0 as a best case, assuming a 50 hour work week.

5. Personal

a. Interest

i. Since I was a child I’ve always been worried about two things: losing my memories and my friends and family dying. The Muninn System, while not perfect, can solve both of these problems. As for my academic background, I am an honors student with a GPA of 4.417 (on a scale of 4) and have started a club at my school about Data Science and Artificial Intelligence. I have been programming and making websites since the middle of seventh grade, and although I haven’t done many research projects for competitions like MIT Think, I have done smaller research projects on my own.

b. Qualifications

i. I currently have Python and Front End Development certifications and have finished the Intro to TensorFlow Lite Course on Udacity. For this project, however, I will need two extra skill sets: AWS and Voice Synthesis.
References

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Preliminary US Death Statistics Suggest More Have Died So Far in 2020 Than in


