Project Proposal

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**Abstract**

A home/personal AI assistant which will leverage ML and natural language processing.

**Background**

To gain a deeper insight into the underpinnings of my project, it is crucial to contextualize its inception. From a young age, I have harbored a fascination for the current era in which we find ourselves, characterized by remarkable advancements in technology. Artificial Intelligence (AI), in particular, has been an enduring allure that has guided my educational pursuit.

As I commenced my academic journey in computer science during my undergraduate program, the burgeoning proliferation of smart home devices and personal assistants served as a catalyst. This engendered within me a long-standing aspiration to conceive a project centered around these technological marvels, a goal I have nurtured over the course of several years. The culmination of this vision is now taking shape as my final semester project.

Throughout my academic journey, I've gained valuable experience, including working on machine learning projects on image identification and utilizing big data. These experiences have provided me with a strong grasp of data principles and programming. However, the project I'm proposing represents a significant departure from my prior work.

The inspiration for this project stems from the growing popularity of smart home devices. While such devices exist, my goal is to take the concept to the next level by creating a personalized AI assistant designed explicitly to enhance convenience and support family life. This project represents a new and more complex domain for me, encompassing machine learning, natural language processing, and real-time data analysis, among other aspects.

In summary, my project builds upon my educational background in computer science while pushing the boundaries of my knowledge and skills. It serves as an opportunity for me to delve into uncharted territory, learn new technologies, and contribute to the evolution of smart home technology, all with a focus on improving the daily lives of families.

Additionally, I plan to leverage existing technologies and tools in areas such as Natural Language Processing (NLP) libraries, speech recognition APIs, machine learning frameworks, smart home integration platforms, IoT protocols, database management systems, web development frameworks, cloud services, open-source AI models, reward system frameworks, and privacy and security tools to enhance and develop various components of my AI assistant. These existing technologies will help me create a robust and feature-rich Home Personal AI Assistant.

**Description**

The aim of my project is to create a comprehensive Home Personal AI Assistant designed to enhance convenience and streamline daily life within a household. The AI assistant will encompass a wide range of features and functionalities to cater to the needs of family members or residents.

**Image Detection and Chore Monitoring:**

One of the core functionalities of the AI assistant will involve image detection capabilities to identify whether household chores have been completed and if they were completed on time. As chores are completed or missed, a rewards system will be implemented, allowing users to earn points for their contributions to household tasks.

**Voice Reminders and Notifications:**

The AI assistant will provide spoken reminders within the household, dynamically broadcasting reminders in the location where the responsible individual is situated.

**Personal User Profiles:**

The system will support personal user profiles for each family member or resident in the household. These profiles will store individual preferences, calendars, and settings tailored to each user's needs and preferences.

**Calendar Synchronization:**

Users will have the ability to synchronize their personal calendars with the AI assistant. This feature will allow them to inquire about their daily agendas, receive timely reminders about appointments, and stay updated on important events.

**Location and Commute Information:**

The AI assistant will provide location-based services, including the ability to inquire about the whereabouts of other users in the household. Users can ask the AI for information about another user's location, distance, and estimated commute time to return home, providing peace of mind and efficient coordination.

**Conversational AI with Learning Capabilities:**

The AI will incorporate conversational AI technology, akin to models like ChatGPT, for coherent general information and natural language interactions. It will continually learn from conversations and interactions that occur within the household. Users will have the flexibility to enable or disable the listening mode in each room as needed, respecting privacy preferences.

**Integration with Smart Home Ecosystem:**

Moreover, the Home Personal AI Assistant will seamlessly integrate with commonly used smart home devices and ecosystems, allowing users to control and manage their connected devices effortlessly. This compatibility ensures that users can leverage their existing smart home infrastructure while harnessing the additional capabilities and convenience offered by the AI assistant. For instance, as part of our audio communication and interaction strategy, we plan to utilize Alexa devices as speakers and microphones, providing high-quality voice interactions and further enhancing the overall user experience. This integration enhances the accessibility and versatility of the AI assistant within the broader smart home context.

In summary, this project will create a Home Personal AI Assistant with an extensive array of features, including image detection for chore monitoring, voice reminders, calendar synchronization, location-based services, and a conversational AI component. This multifaceted system aims to enhance the daily lives of users by providing organization, convenience, and personalized support within a household environment.

**Target Audience**

The project's intended audience comprises households and families seeking to enhance their daily routines and communication within the home environment. This includes working professionals looking for efficient task management and commute information, students aiming to balance academic responsibilities, tech enthusiasts interested in exploring cutting-edge technology, and smart home enthusiasts seeking compatibility with existing devices. Additionally, privacy-conscious users will appreciate the flexibility to control listening modes in different rooms, ensuring respect for their privacy preferences while benefiting from the AI assistant's convenience and assistance.

**Success Criteria**

Due to the nature and complexity of this project and the fact that most of the things done will have to be learned, I might not have time to finish everything in a professional way. The success criteria for this project will be defined by achieving the following key milestones within the three-month timeframe:

1. **Functional Home Personal AI Assistant:** The core success criterion is the development of a fully functional Home Personal AI Assistant capable of performing tasks such as image detection for chore monitoring,rewards system, providing voice reminders, syncing user calendars, offering location-based services, and engaging in coherent conversations through the conversational AI component.
2. **Integration with Smart Home Devices:** The AI assistant should seamlessly integrate with common smart home devices and ecosystems, demonstrating compatibility and ease of control over connected devices.
3. **Learning and Adaptation:** The AI should showcase learning capabilities by continually improving its understanding of user preferences, speech patterns, and household dynamics through interactions, effectively enhancing user experiences over time.

**Scope**

**Included**

* **Image Detection and Chore Monitoring:** The AI assistant will possess image detection capabilities to identify completed or missed household chores and implement a rewards system based on these observations.
* **Voice Reminders and Notifications:** The AI assistant will provide spoken reminders and notifications within the household, tailored to the location of the responsible individuals.
* **Personal User Profiles:** The system will support individual user profiles for family members or residents, storing their preferences, calendars, and personalized settings.
* **Calendar Synchronization:** Users will be able to synchronize their personal calendars with the AI assistant, enabling inquiries about daily agendas, appointment reminders, and event updates.
* **Location and Commute Information:** The AI assistant will offer location-based services, including the ability to inquire about the whereabouts of other users in the household and estimate their commute time.
* **Conversational AI:** The AI will incorporate conversational AI technology.
* **Integration with Smart Home Ecosystem:** The project will integrate seamlessly with common smart home devices and ecosystems, enabling users to control and manage their connected devices effortlessly. This integration will include the use of Alexa devices as speakers and microphones to enhance voice interactions.

**The project's scope explicitly excludes the following aspects:**

**Advanced AI Learning and Behavior:** While the AI assistant will have learning capabilities, achieving highly advanced AI behaviors may exceed the project's timeframe.

**Advanced Security Features:** While privacy and security are considered, advanced security features beyond standard encryption and user-controlled listening modes may require additional development time.

**Extensive User Testing and Feedback:** Comprehensive user testing and iterative feedback may extend beyond the project's initial three-month timeframe.

**User Interface Development:** Due to time constraints, the development of a sophisticated user interface will not be considered as part of this project, with the focus primarily on backend functionality and capabilities.

1. **Significance**

My project holds significance on multiple fronts, aligning with the expectations for significant projects in various ways:

* **Enhancing Daily Life:** The project aims to create a Home Personal AI Assistant that directly impacts the daily lives of households and families. By automating and optimizing tasks, providing reminders, and offering personalized support, it significantly enhances convenience, productivity, and organization within the home environment.
* **Leveraging Emerging Technologies:** The project leverages cutting-edge technologies such as machine learning, natural language processing, and smart home integration. By harnessing these technologies, it stays at the forefront of technological advancements, offering users a glimpse of the possibilities AI can bring into their lives.
* **Empowering Users:** The AI assistant empowers users by providing them with tools to manage their schedules, chores, and daily routines more efficiently. It caters to the needs of working professionals, students, and individuals with diverse daily responsibilities, enabling them to strike a balance and make informed decisions.
* **Family-Centric Approach**: By offering features tailored to family life, such as chore monitoring, location tracking, and synchronized calendars, the project strengthens family bonds and contributes to smoother household management. It recognizes the significance of family dynamics in today's society.
* **Exploration of New Horizons:** The project represents an opportunity for me to delve into uncharted territory, learning new technologies, and contributing to the evolution of smart home technology. It signifies a significant personal and educational journey.
* **Integration with Smart Home Ecosystem**: The seamless integration with common smart home devices and ecosystems ensures that users can make the most of their existing investments in smart home technology, amplifying the significance of their prior choices.

In summary, this project's significance lies in its potential to transform the way families manage their daily lives, harnessing emerging technologies, and prioritizing user empowerment, privacy, and control. It embodies innovation and exploration, contributing to the ongoing evolution of smart home technology while addressing the real needs and challenges of modern households.

1. **New Computer Science Concepts**

I will need to learn and apply several computer science and software engineering concepts, many of which are new or require a deeper understanding. Here are the key topics and areas I'll need to delve into:

**Natural Language Processing (NLP):** Understanding the fundamentals of NLP will be crucial for developing conversational AI capabilities. I will not try to reinvent the wheel, but I need to learn how to use what is open source and meets the needs of this project.

**Real-Time Data Analysis:** Handling and analyzing real-time data generated by user interactions and smart home devices will require knowledge of data streaming, real-time databases, and data processing frameworks like Apache Kafka and Apache Flink.

**Smart Home Integration Protocols:** Learning about common IoT protocols like MQTT and protocols specific to smart home ecosystems will be essential for seamless integration with smart home devices.

**Database Management Systems:** Understanding and implementing efficient database management systems for storing user profiles, chore data, and user preferences, with a focus on database design, indexing, and query optimization.

**Cloud Services:** Utilizing cloud platforms like AWS, Azure, or Google Cloud for scalable and reliable hosting, as well as serverless computing for backend functionality.

**Open-Source AI Models:** Exploring and integrating pre-trained open-source AI models, such as ChatGPT, for natural language understanding and generation.

**Privacy and Security Practices:** Acquiring knowledge of best practices in privacy and security, including encryption, user authentication, and secure data storage, to safeguard user information.

**Reward System Frameworks**: Developing a rewards system may involve learning about gamification concepts and frameworks for implementing a points-based reward system effectively.

**User Experience (UX) Design:** Even though the project scope excludes a sophisticated user interface, gaining a basic understanding of UX principles will help in creating a user-friendly experience.

**Agile Project Management:** Implementing agile methodologies for project management, including practices like Scrum or Kanban, to ensure efficient progress tracking and adaptation.

**Continuous Integration and Deployment (CI/CD):** Learning CI/CD pipelines and tools like Jenkins or Travis CI to automate testing and deployment processes.

**Containerization:** Familiarizing myself with containerization technologies like Docker and container orchestration platforms like Kubernetes for efficient application deployment.

**Version Control:** Ensuring effective version control using Git to manage project code and collaborate with potential team members.

**User Testing and Feedback:** Developing skills in user testing and feedback collection methodologies to iteratively improve the AI assistant based on user insights.  
 **Concepts with some experience:**

**Machine Learning for Image Detection:** To implement image detection for chore monitoring, I have done something similar, but it was a while ago. I'll need to visit topics like image processing, feature extraction, and machine learning algorithms for object detection, such as Convolutional Neural Networks (CNNs).  
  
**Big Data:** Dealing with large amounts of data.

These topics collectively represent a significant learning journey, and while I have a foundation in computer science and software engineering principles, diving deeper into these areas will be essential for the successful development of the Home Personal AI Assistant.

1. **Interestingness**

This project is incredibly interesting and exciting to me for several reasons. Firstly, it merges two of my greatest passions: technology and improving everyday life. The idea of creating a Home Personal AI Assistant that can bring convenience and support to families is not only intellectually stimulating but also deeply rewarding.

Furthermore, the project represents a significant leap beyond my prior experiences. It challenges me to explore new horizons in fields such as natural language processing, image recognition, and real-time data analysis. The prospect of learning and applying these cutting-edge technologies is both daunting and exhilarating.

The potential impact on households is what fuels my enthusiasm. Knowing that the AI assistant I'm developing could genuinely enhance the daily lives of families, helping them stay organized, communicate more effectively, and save time, is a powerful motivator. This sense of purpose keeps me committed to the project, even when faced with obstacles and challenges that are inevitable in senior projects.

In essence, the combination of technological innovation, personal growth, and the prospect of making a positive difference in people's lives makes this project incredibly interesting and exciting. It's not just a senior project; it's a journey of exploration and meaningful contribution that I am fully committed to seeing through.

1. **Tasks and Schedule**

Project: Home Family AI Assistant

Total Estimated Hours to Completion: 300 hours

**Week 1-2:** Project Planning and Research (Total: 30 hours)

- Define project scope and objectives (2 hours)

- Set project objectives (2 hours)

- Research AI technologies (3 hours)

- Identify hardware and software requirements (3 hours)

- Create initial project timeline (2 hours)

- Define roles and responsibilities (3 hours)

- Set up project communication channels (5 hours)

- Choose development environment (2 hours)

- Install necessary software (5 hours)

- Configure development tools (2 hours)

- Set up version control system (2 hours)

- Create a basic project structure (1 hour)

**Week 3-4**: Data Collection and Dataset Preparation (Total: 30 hours)

- Identify data sources (2 hours)

- Collect data for image recognition (6 hours)

- Clean and preprocess collected data (6 hours)

- Annotate and label data (6 hours)

- Research image recognition algorithms (2 hours)

- Choose a suitable deep learning framework (2 hours)

- Develop and train the image recognition model (4 hours)

- Evaluate model performance (2 hours)

**Week 5-6:** Conversational AI Development (Total: 29 hours)

- Research NLP libraries and tools (3 hours)

- Set up NLP development environment (3 hours)

- Develop basic conversational AI functionality (7 hours)

- Test and iterate on conversational AI component (7 hours)

- Set up server infrastructure (2 hours)

- Design and create databases (2 hours)

- Develop backend APIs (4 hours)

- Implement user authentication (1 hour)

**Week 7-8:** Testing and Debugging (Total: 30 hours)

- Develop test cases and scenarios (4 hours)

- Conduct unit testing (4 hours)

- Perform integration testing (7 hours)

- Address identified issues (7 hours)

- Optimize system performance (6 hours)

- Create user documentation outline (1 hour)

- Write user guides and FAQs (1 hour)

- Prepare system documentation (2 hours)

**Week 9-10**: User Testing and Feedback (Total: 30 hours)

- Recruit user testers (2 hours)

- Conduct usability testing sessions (6 hours)

- Gather and analyze user feedback (7 hours)

- Implement user feedback-driven improvements (7 hours)

- Perform final system testing (5 hours)

- Optimize system performance and responsiveness (3 hours)

**Week 11:** Milestones and Finalization (Total: 26 hours)

- Prepare and review requirements specification (4 hours)

- Prepare presentation materials (4 hours)

- Conduct a practice presentation (2 hours)

- Deliver the project demonstration (2 hours)

- Write the final project report (10 hours)

- Review and proofread the report (4 hours)

**Week 12-13:** Reflection and Documentation (Total: 25 hours)

- Reflect on the project's successes and challenges (3 hours)

- Document lessons learned and areas for improvement (22 hours)

1. **Required Resources with Costs**

* **Computer/Server:** We'll require a robust computer or server to serve as the backbone of our AI assistant. This machine should possess ample processing power(and memory capacity to handle complex machine learning tasks and server operations).
* **Motherboard and tower :** $156.18
* **CPU:** ntel - Core i5-12600K Desktop Processor 10 (6P+4E) Cores up to 4.9 GHz Unlocked LGA1700 600 Series Chipset 125W – $179
* **RAM:** 16 - 32 GB $77.99
* **GPUS:** No purchase needed - Having access to two RTX 2070 Super GPUs opens up exciting possibilities for my project. These powerful graphics cards excel in parallel processing, which translates to significantly faster model training and real-time decision-making for my AI assistant. Their robust capabilities make them ideal for tackling complex tasks like image recognition, natural language processing, and efficiently managing extensive datasets. $1600
* **Power Supply:** No purchase needed - EVGA SuperNOVA 850W GA 80+ Gold Power Supply - $241.28
* **Cameras:** No purchase needed
* **Alexa devices:** No purchase needed
* **Smartphone:** No purchase needed

**References**

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- Jarvis Farley's website. (n.d.). Retrieved from https://jarvisfarley.com/

- RoomCheck: Detecting Clean-vs-Messy Rooms. (n.d.). Retrieved from https://jarvisfarley.com/code/roomcheck/

**2. Amazon Alexa Developer Documentation:**

- Amazon Alexa Skills Kit (ASK). (n.d.). Retrieved from https://developer.amazon.com/en-US/alexa/alexa-skills-kit

- Alexa Voice Service (AVS). (n.d.). Retrieved from https://developer.amazon.com/en-US/alexa/alexa-voice-service

**3. Google Calendar API Documentation:**

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**4. Voice User Interface (VUI) Design:**

- Amazon Alexa. (n.d.). Voice User Interface (VUI) Design Guide. Retrieved from https://developer.amazon.com/en-US/alexa/design

**5. Programming and Development Guides:**

- Node.js SDK for Alexa Skills Kit. (n.d.). Retrieved from https://github.com/alexa/alexa-skills-kit-sdk-for-nodejs

- Google Calendar API Client Libraries. (n.d.). Retrieved from https://developers.google.com/api-client-library

- ChatGPT Assistant. Retrieved from https://chat.openai.com/

**6. Community Forums and Support:**

- Amazon Alexa Developer Forum. (n.d.). Retrieved from https://amazon.developer.forums.answerhub.com/

**7. Natural Language Processing (NLP) Libraries:**

- NLTK (Natural Language Toolkit): [Official NLTK Documentation](https://www.nltk.org/)

**8. Machine Learning Frameworks:**

- TensorFlow: [TensorFlow Documentation](https://www.tensorflow.org/)

- PyTorch: [PyTorch Documentation](https://pytorch.org/)

**9. Smart Home Integration Platforms:**

- Apple HomeKit: [Apple HomeKit Documentation](https://developer.apple.com/homekit/)

- Samsung SmartThings: [Samsung SmartThings Developer Portal](https://developer.samsung.com/smartthings)

- OpenHAB: [OpenHAB Documentation](https://www.openhab.org/docs/)

**10. IoT Protocols:**

- MQTT (Message Queuing Telemetry Transport): [MQTT.org](http://mqtt.org/)

- CoAP (Constrained Application Protocol): [CoAP Documentation](https://coap.technology/)

**11. Database Management Systems:**

- PostgreSQL: [PostgreSQL Documentation](https://www.postgresql.org/docs/)

- MongoDB: [MongoDB Documentation](https://docs.mongodb.com/)

**12. Cloud Services:**

- Amazon Web Services (AWS): [AWS Documentation](https://docs.aws.amazon.com/)

- Google Cloud Platform (GCP): [Google Cloud Documentation](https://cloud.google.com/docs)

**13. Open-Source AI Models:**

- Hugging Face Transformers: [Hugging Face Transformers Documentation](https://huggingface.co/transformers/)