
VIT-AP UNIVERSITY

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# ENGINEERING CLINICS II
# (ECS3001)

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# SUMMARY OF THE PROJECT

The Smart Cap Initiative seeks to address the gap between practical fashion and the latest tech trends through the creation of an ordinary cap that will serve as a smart device, which the user will not be required to hold and will not occupy his hands. A Raspberry Pi, a camera, a pair of speakers, and a microphone form the hardware of the Smart Cap, where AI and navigation technologies work to make the life of the user easier. Through the use of Integrating Gemini AI with Google Maps, this cap gives users the capabilities of voice navigation while walking and searching for object information on the cap itself. This functionality transcends that of a simple smart wearable—providing information about one's route, the temperature and precipitation in real-time, or recognizing objects around—turns it into a digital assistant. The main focus of this undertaking is to harness the use of Artificial intelligence in a device that is worn, thus beautiful and practical, a device that allows the users to interact with it without using their hands in an easy and efficient manner. Further versions might have improved voice recognition feature and advanced AI technology which are expected to improve the experience of the user even more.

# INDEX



Demo Video

# INTRODUCTION

In the world we live, we are constantly creating new devices to reduce manual workloads and simplify life. We weren't satisfied with keypad phones, which led to the creation of smartphones. Regular wristwatches became boring, so we invented smartwatches. Similarly, everyday items we frequently use need to be improved to provide the best results. This got us thinking about caps and how we could make a smart cap. Yes, you heard that right, an ordinary cap, often used in summer to shield us from the sun, can be enhanced with features similar to those of a smartwatch or smartphone.

Introducing the "Smart Cap", a device that can simplify tasks like using Google Maps, checking the time, getting weather updates, playing music, and much more. We present our project, the "Smart Cap," with innovative features that transform a simple cap into a Smart Cap.

# BACKGROUND:

❖ Everyday Needs

In our daily lives, we use devices like smartphones, smartwatches, and earbuds to make things easier and more enjoyable. We're often drawn to anything labelled "smart" because it helps with everyday tasks. This brings attention to a simple cap we often wear, which could be transformed into something smart and unique - the "Smart Cap."

❖ Introducing the Smart Cap

A regular cap, often worn to protect from the sun or for style, can be transformed into a "Smart Cap," making it much more useful than its original purpose. Now, it's no longer just a cap, and it can assist with our daily tasks.

❖ What the Smart Cap Can Do

The "Smart Cap" is designed to be easy to use and helpful in everyday tasks. It can recognize objects around you, work as an assistant by answering your questions through Gemini, provide directions to your destination, tell you the current time, and give weather forecasts.

# PROBLEM DEFINITION:

With the advent of technology today, most people have found it convenient to use smart devices that help in carrying out their daily activities in the shorter time and minimal effort. Nevertheless, things like mobile phones, smart watches, and earpieces to mention few have become the order of the day but they usually need one to handle them actively which is inconvenient when the person is multi-tasking or in motion. Despite great advances made in the development of wearable technology, there are no swift high-tech solutions to befit other regular objects such as caps which can provide assistance through hands-free voice commands.

The problem however is taking an ordinary cap most people wear in sunny weather for aesthetic or protective purposes and fitting it with smart technologies. Essentially making a machine that goes beyond the typical convenience and accessibility of wearable gadgets. Through the use of so called “Smart Cap” instead of a plain headwear, we will be able to give the users a specialized headgear that helps in orientation, accessing data, identifying objects, or communications with artificial intelligence. This advance does not only enhance the purpose of an everyday device that is the cap but also enables a vision of use, where information and tools will be available to the users always and everywhere, even when their hands are busy thereby rewriting the meaning of wearable technology.

# OBJECTIVE OF THE PROPOSED WORK:

The primary objectives of the Smart Cap project are:

- To create a functional wearable device that allows users to perform routine tasks hands-free.
- To integrate essential features like navigation, object detection, and voice-based interaction.
- To explore innovative applications of Raspberry Pi and AI technology in wearables.
- To design a cap that can function as an intelligent assistant, offering real-time support and information.

# METHODOLOGY/PROCEDURE:

❖ Component Selection

Key components of the Smart Cap include:

1. **Raspberry Pi 4 Model B+**: Serves as the processing unit.
2. **Pi Camera**: Captures images for object detection.
3. **Mini Speakers and Microphone**: Enable voice interaction.
4. **Power Bank**: Provides power for extended operation.
5. **Other Accessories**: A case for the Raspberry Pi and the cap structure itself.

❖ Software and Setup

1. **Initial Setup**: Install Raspberry Pi OS and configure necessary Python packages.
2. **Gemini AI Integration**: Use the Gemini AI model for processing voice inputs and providing relevant responses.
3. **Google Maps API Integration**: Use Google Maps for navigation features, including real-time directions and location tracking.
4. **Object Detection**: Install TensorFlow Lite for object recognition and integrate it with the Pi Camera.

❖ Prototype Development

1. **Hardware Assembly**: Attach components like the camera, speakers, and microphone to the cap.
2. **Coding and Testing**: Write scripts for individual features and integrate them into the main program.
3. **Feature Testing**: Conduct tests for each feature (AI assistant, navigation, object detection) to ensure they work as expected.

❖ Key Implementation Steps

1. Clone repository for assistant setup and run setup script.
2. Start individual components by initializing services (e.g., Google Maps for navigation).
3. Run object detection via a dedicated TensorFlow Lite script.

# RESULTS AND DISCUSSION:

❖ Review 1: Initial Setup

In the first review, we established the problem statement and designed a basic prototype of the Smart Cap. Key components were tested individually to ensure compatibility and functionality.

❖ Review 2: Intermediate Implementation

The project's second phase involved integrating the Google Maps API, Gemini AI assistant, and object detection. We implemented voice commands for hands-free interaction, with successful initial tests showing promise for real-world application.

❖ Review 3: Final Testing and Improvements

During the final review, we improved user experience by adding a menu system and refining features for smoother operation. The Smart Cap now supports tasks like playing music, chat with AI , guiding routes, and object recognition, all controlled by simple voice commands.

# CONCLUSION AND FUTURE SCOPE:

The Smart Cap project demonstrates the potential of integrating AI and navigation technology into wearable devices. It successfully transforms a basic cap into a multi-functional device, enabling hands-free interaction for tasks like navigation and object detection.

Future improvements could include more advanced object detection, and the following:

- Travel and Navigation: Enhanced navigation tools for visually impaired individuals or outdoor adventurers, including offline map capabilities.

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## CODES IN APPENDIX:

**GitHub - Versus04/ecs**