

Introduction

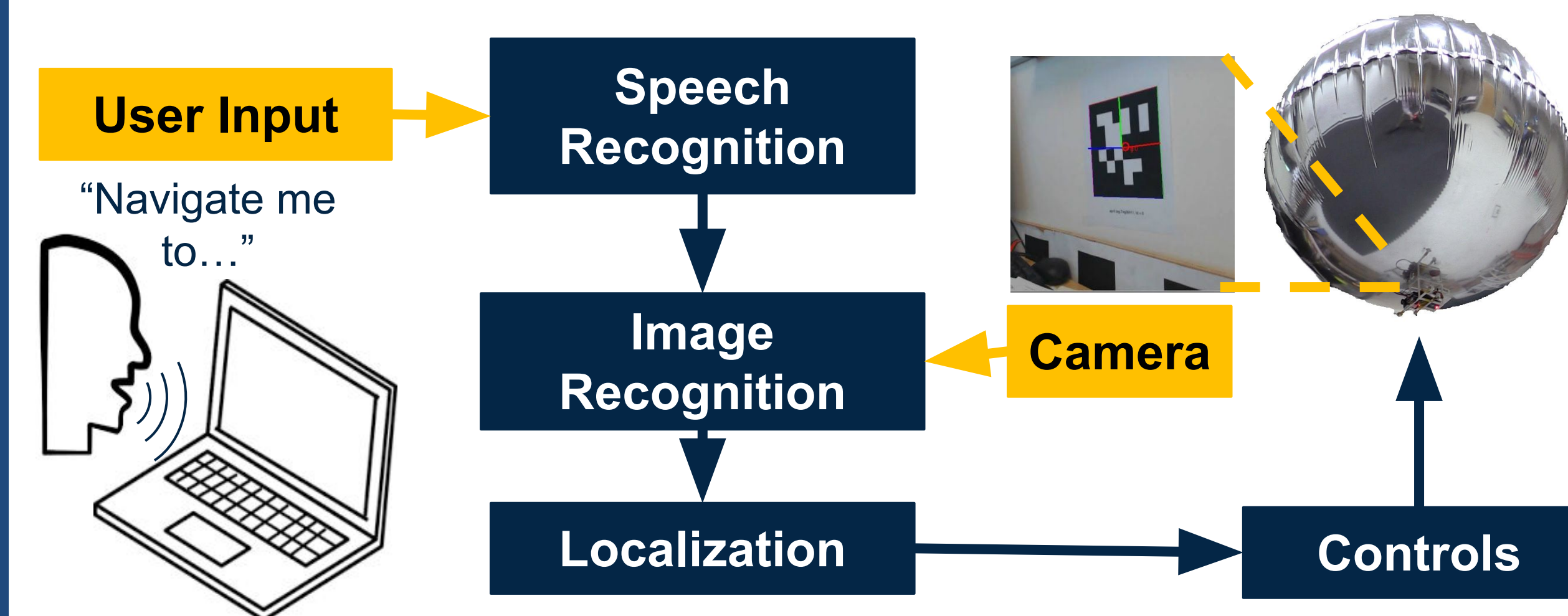
- **Navigation** in an unknown environment can be confusing for humans
- **Robots** can help humans find their way
 - **Quadcopters** are dangerous in populated indoor environments
 - **Wheeled/Walking Robots** have to contend with navigating around objects and humans on the floor
 - **Blimps** are ideal for indoor spaces because they have long flight times and do not injure humans in collisions



Solution

- Enable **speech recognition** and **feedback control** on a blimp to guide users to desired destinations
- Eliminate the need for a fixed, expensive localization setup
- Remove barrier to **intuitive human-robotic relationships**
- Reduces learning curve for controlling the blimp by replacing an app with speech recognition

Design Schematic



Design Components

Speech Recognition

- Implemented **Google's Speech-to-Text** API on a Koss Communications USB microphone connected to a laptop

Image Recognition

- **AprilTags** will be used as markers on the walls as they are easily recognizable with a Robotics Operating System (ROS) AprilTags image classifier running on the blimp's camera
- Had to decide between two different image families

Localization

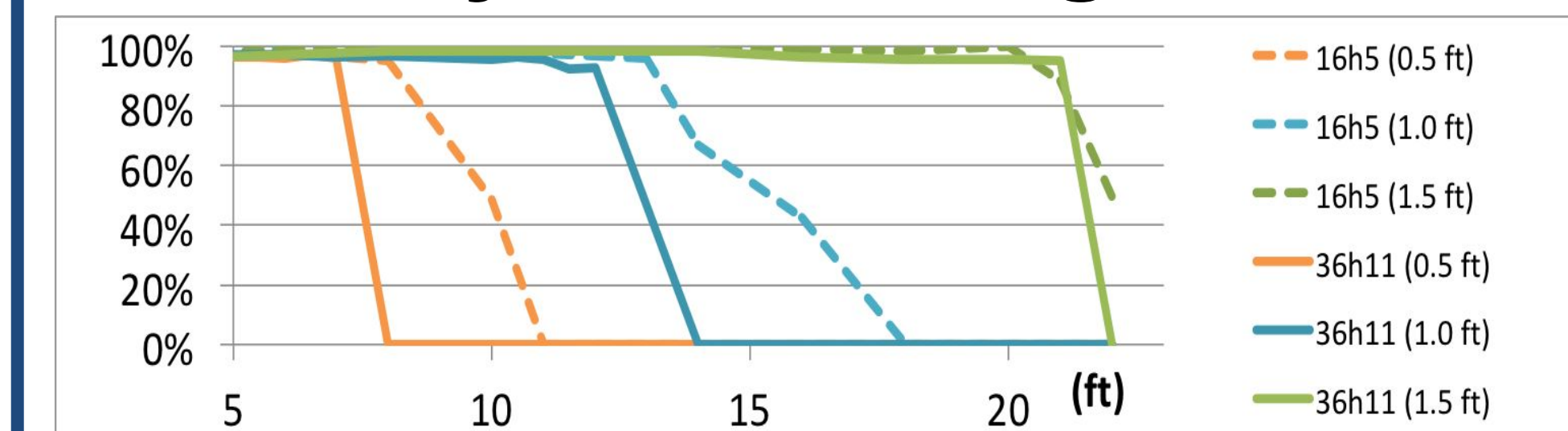
- Calculate the current position of the blimp given known image locations
- Experienced issue with too many false positives to calculate position accurately

Controls

- Used a **feedback control loop** to guide the blimp toward an image using the position of the image relative to the blimp camera to provide the feedback

Results

Distance Measurement Accuracy vs True Tag Distance



- Note the different lines are measurements from different tag shapes, and sizes
- In general, for large tag sizes, the blimp was able to localize from 20 ft distances

Conclusion

- The minimum size AprilTags image we need to use is **1.5 ft²** which provides a maximum range of **20 ft**
- The blimp went to the right destination **68%** of the time which is just shy of the 70% success rate specification

Future Work

- **Implement waypoint navigation** to a destination not visible to the starting position
- **Improve localization** by using the positions of the images relative to each other