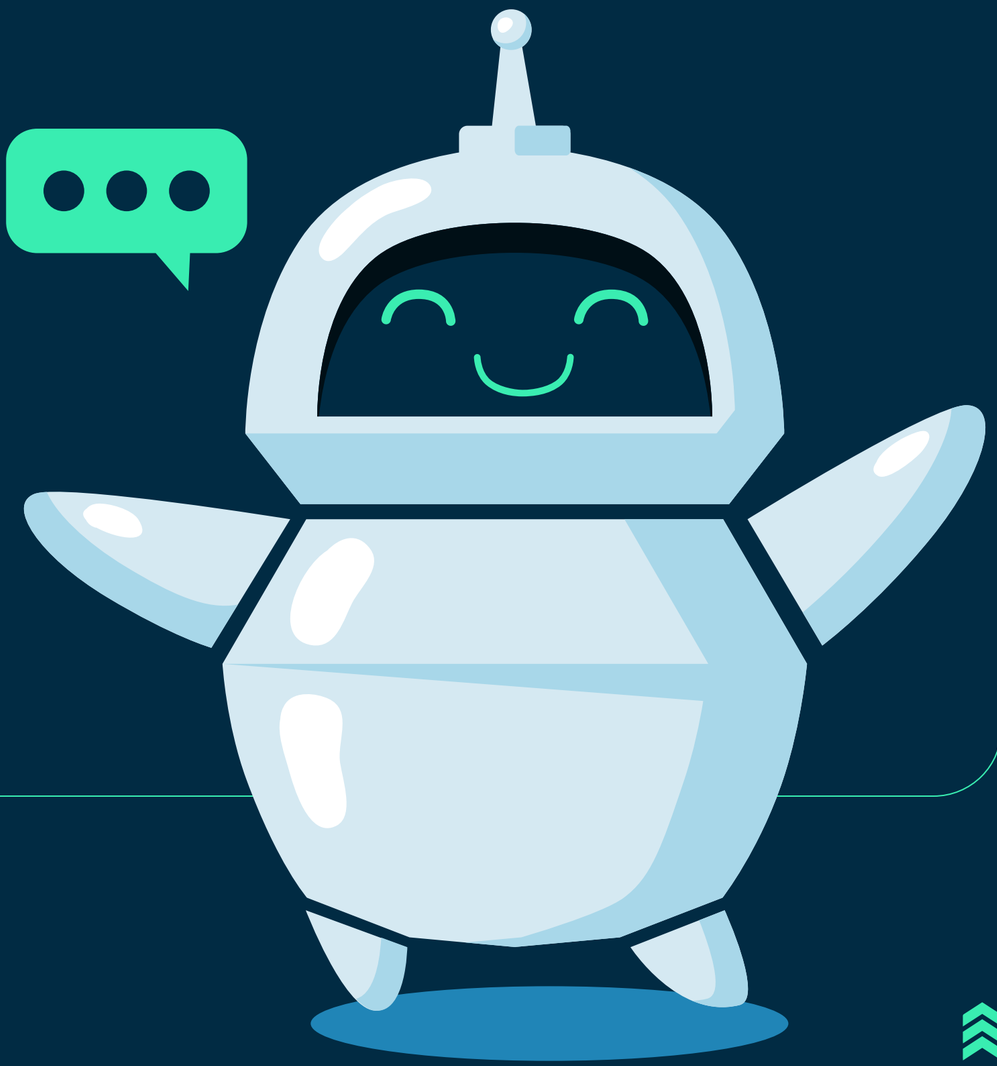
AI-SOCIAL ROBOT FOR UNIVERSITY ASSISTANCE

- ECEN 403 – Senior Design I
- Mentor: Dr. Jim Ji



Team 2 Members

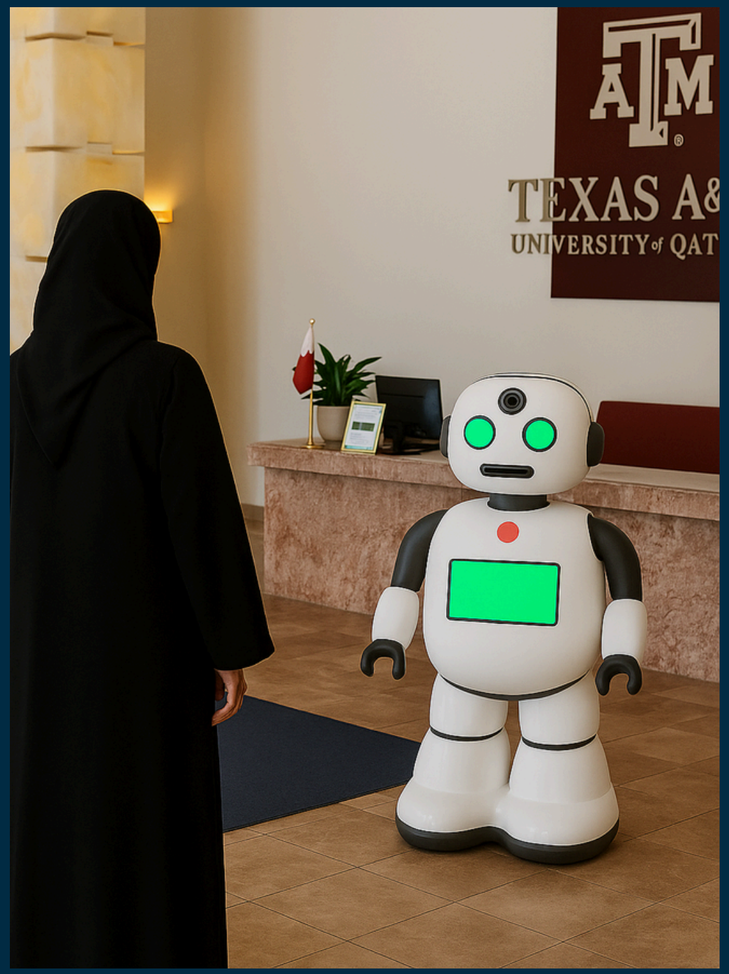
- **Noor Almohammadi**
  Hardware Lead

- **Maryam Al-Obaidan**
  Team Leader & Arduino Developer

- **Amna Al-Zeyara**
  Software Developer - Python

Semester: Summer 2025

INTRODUCTION & PROBLEM STATEMENT



•Introduction:

University environments can be challenging for new students and visitors unfamiliar with campus layout and services.

•Problem Statement:

•Reception desks often become crowded ,and human staff may have limited knowledge and may not always be available .

•Lack of interactive support for student navigation and engagement.

INTRODUCTION & PROBLEM STATEMENT

•**Objective:**

Robot that recognizes students, gathers name, major, and ID, and provides spoken directions.
For visitors, the robot asks about their purpose of visit, and guides them to relevant locations.
It can also play the Aggie song.

Why it matters:

•Helps students feel confident and independent on campus.

•Reduces staff workload and enhances accessibility for all users.

PROPOSED SOLUTION

•**System Components:**

–**Arduino Mega** the main control system connected to a laptop via USB

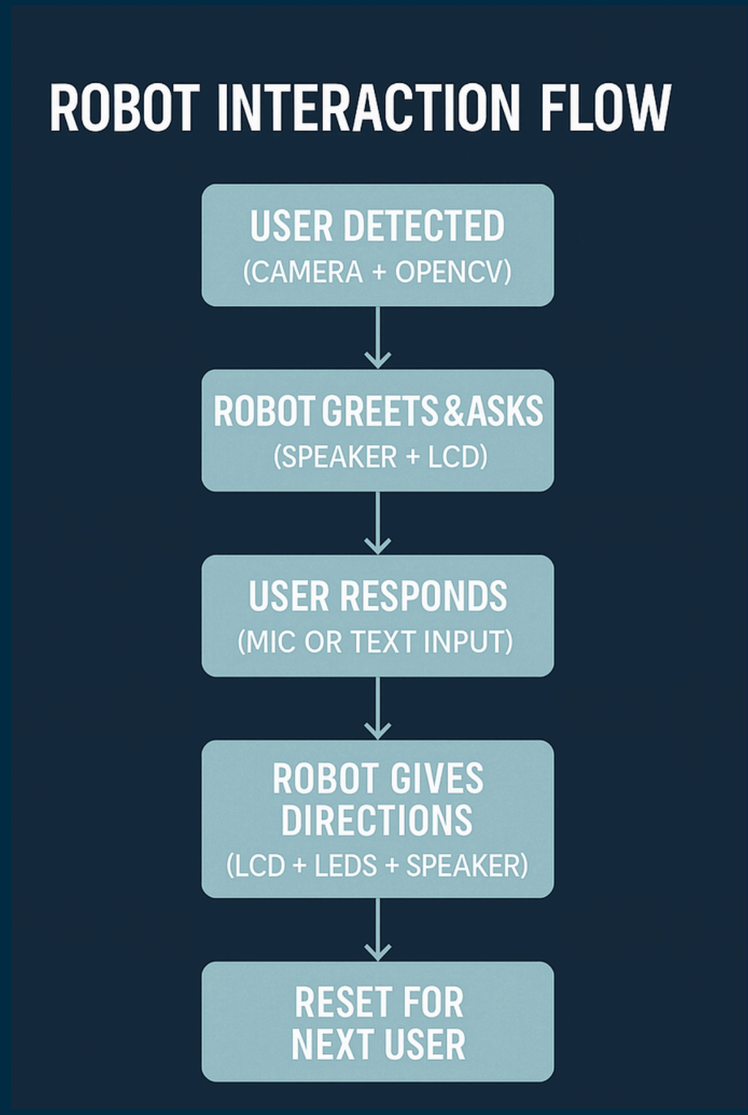
-**Laptop** to runs python code

–**Python** (OpenCV) for facial recognition

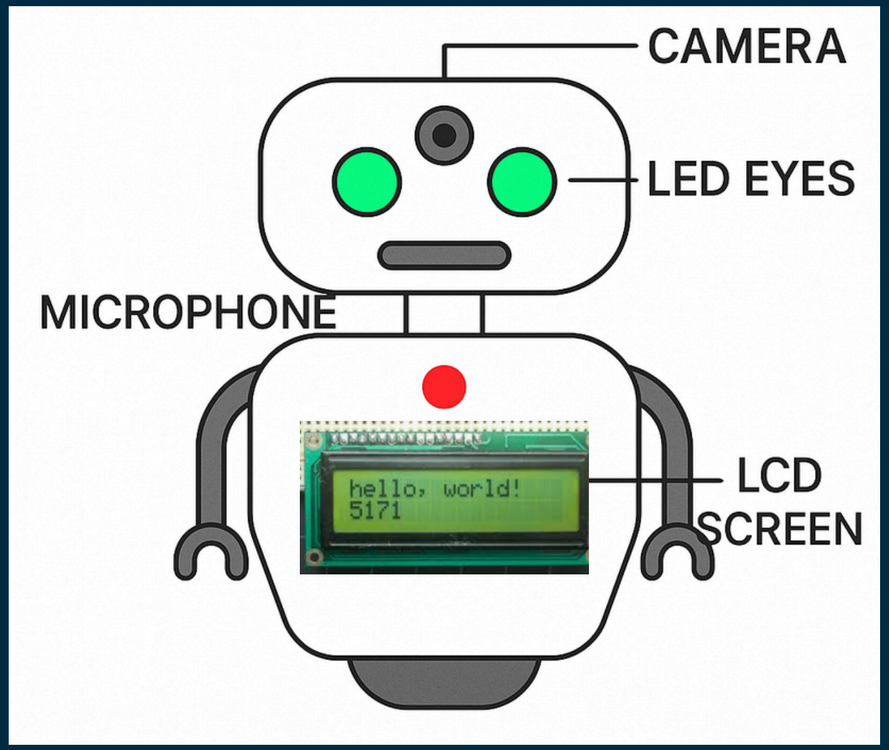
–**MP3** and **speaker** module for voice responses

-**LCD screen** for displaying directions

–**LEDs** for visual signals



INTERFACE DESIGN



- **Hardware:**

–Camera module

–Microphone

–LED eyes

–Speaker

-LCD Screen

-Arduino cabel

-Laptop

- **Software:**

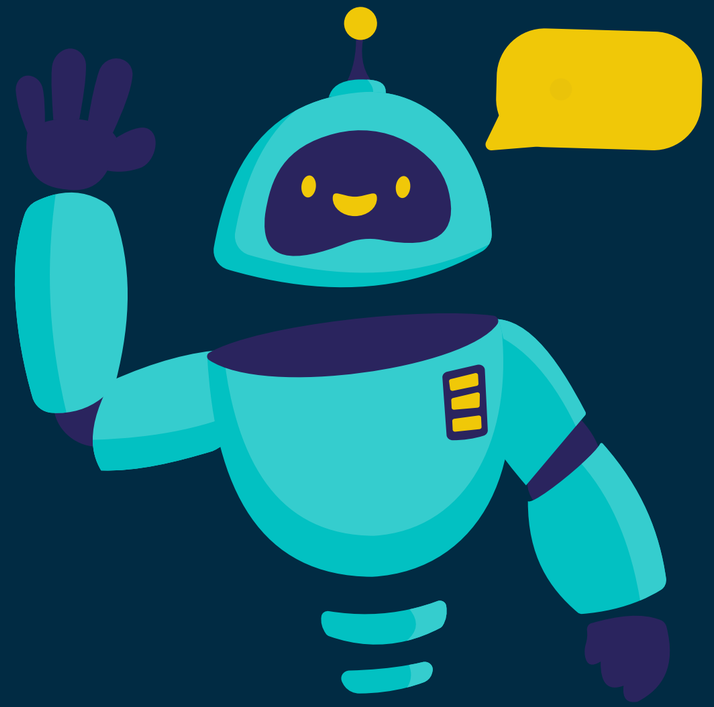
–Python GUI (Graphical User Interface)
to interact with users and display output.

–Backend script for recognition and audio responses.

TECHNICAL STANDARDS CONSTRAINTS & RISKS

- **Standards:**

- IEEE 1621, focuses on user interface indicators (UI)
- USB Communication



- **Constraints:**

- Budget Limit ($1260):
  Use low-cost hardware like Arduino, open-source software.

- Component Delays:
  Order early and have backup suppliers ready.

TECHNICAL STANDARDS CONSTRAINTS & RISKS

Risks:

- **Crowded Desks**

Can create background noise so we plan to use directional mics, and if needed, switch to screen-based input.

- **Response Lag:**

If internet connection is weak we will perform local processing to avoid delays.

- **Lighting Issues:**

Lighting can affect facial recognition so we will use low-light or IR (Infrared) cameras and software-based brightness control to adjust different environments.

PERFORMANCE CRITERIA

Metric	Description
Cost-efficiency	Evaluates affordability for educational institutions in terms of both development and deployment.
Facial Recognition Accuracy	Assesses the robot's ability to detect and recognize user faces reliably under varied lighting and angles.
Voice Interaction Quality	Measures the clarity and accuracy of verbal communication between the robot and the user.
Customizability	Degree to which the hardware and software can be modified for different educational applications.
Ease of Development	Technical knowledge required by students or faculty to set up, modify, or expand the robot.
Safety & Data Privacy	Evaluates physical safety of the robot and ethical handling of personal data.
Cultural & Social Accessibility	Ability to adapt to diverse university populations, languages, and user needs.
Environmental Impact	Analyzes power consumption and use of sustainable or recyclable materials in the build.
Public Health & Welfare Impact	Measures usefulness in educational support, student engagement, and potentially therapeutic scenarios. Also considers user safety through stationary design and low-voltage components

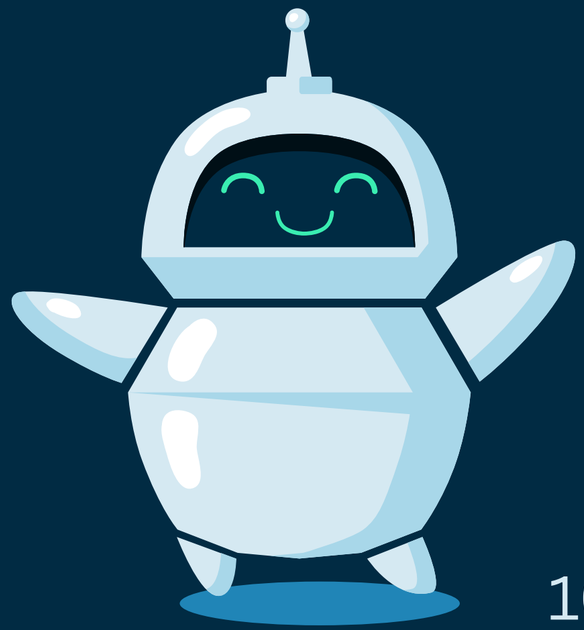
EXISTING SOLUTIONS

1. Pepper Robot by SoftBank Robotics
- Advanced features, but expensive and closed-source

2. Jibo
- Voice assistant, but discontinued and cloud-reliant

3. Temi Robot
- Smart features, but hard to modify

4. InMoov Robot
- Open-source, but very complex

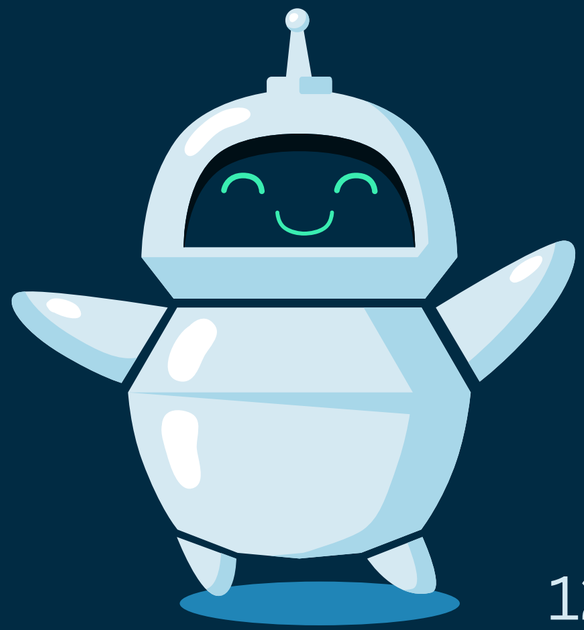


EXISTING SOLUTIONS VS OUR DESIGN

Criteria	Pepper	Jibo	Temi	InMoov	Proposed Robot
Facial Recognition Accuracy	High	Medium	High	Depends on config	High (OpenCV)
Voice Interaction	High (cloud)	Medium	Medium	Low	High
Customizability	Low	Low	Medium	High	High
Ease of Development	Low	Medium	Medium	Low	Medium
Data Privacy	Medium	Low	Low	High	High
Accessibility (Cultural)	Medium	Low	High	Medium	High (Multilingual)
Environmental Impact	Low	Low	Medium	Medium	Medium
Public Health Applications	High	Low	Medium	Low	High
Cost	$$$$$ ($20,000+)	$$$ ($900)	$$$$ ($3,500)	$$ (~$700+)	$ (~$1200)

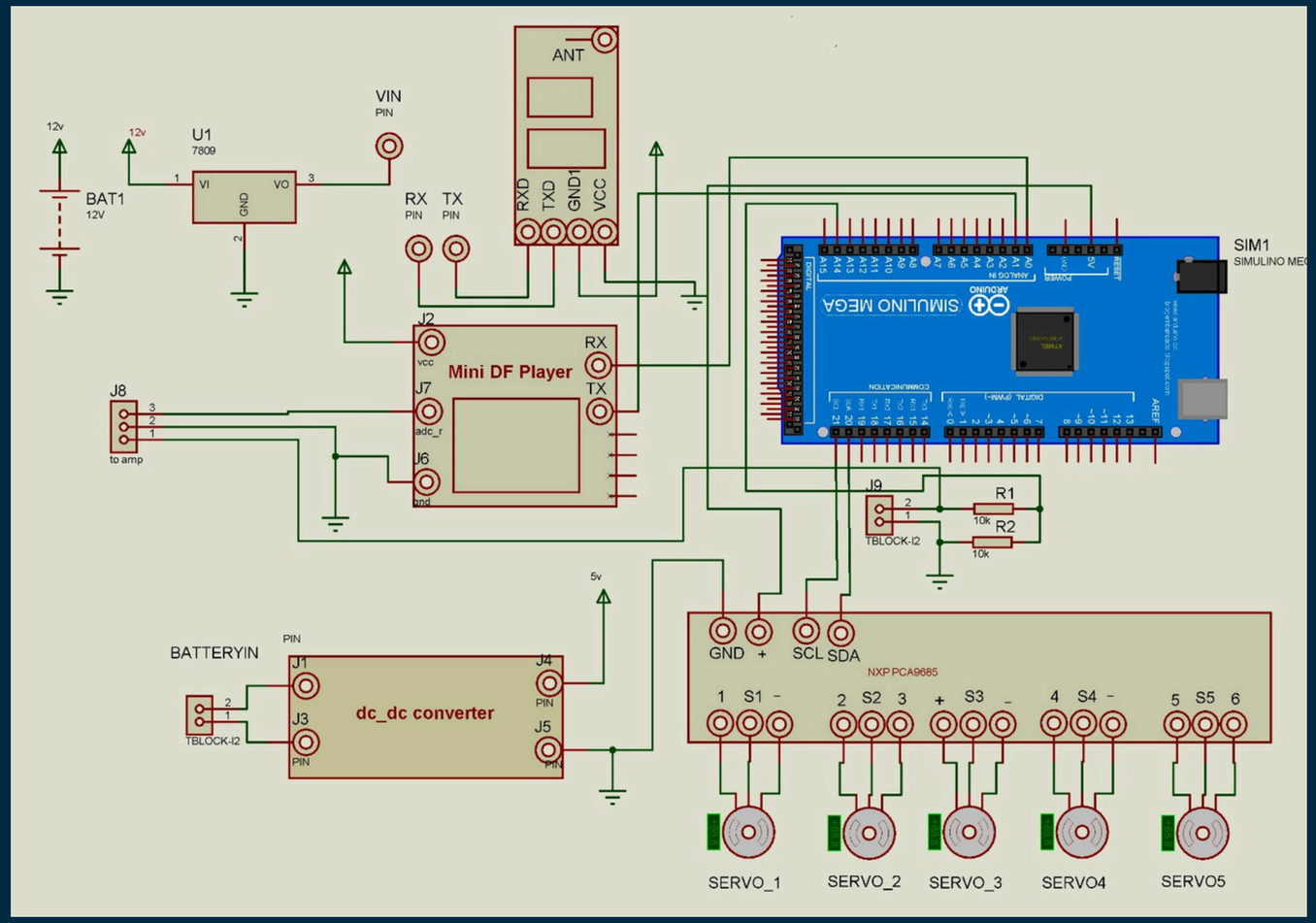
OUR DESIGN

- Affordable and user-friendly
- Built with open-source tools (Python, Arduino)
- Easy to set up and maintain
- Designed specifically for campus help
- Focuses on real needs (directions)
- LCD screen displays readable directions

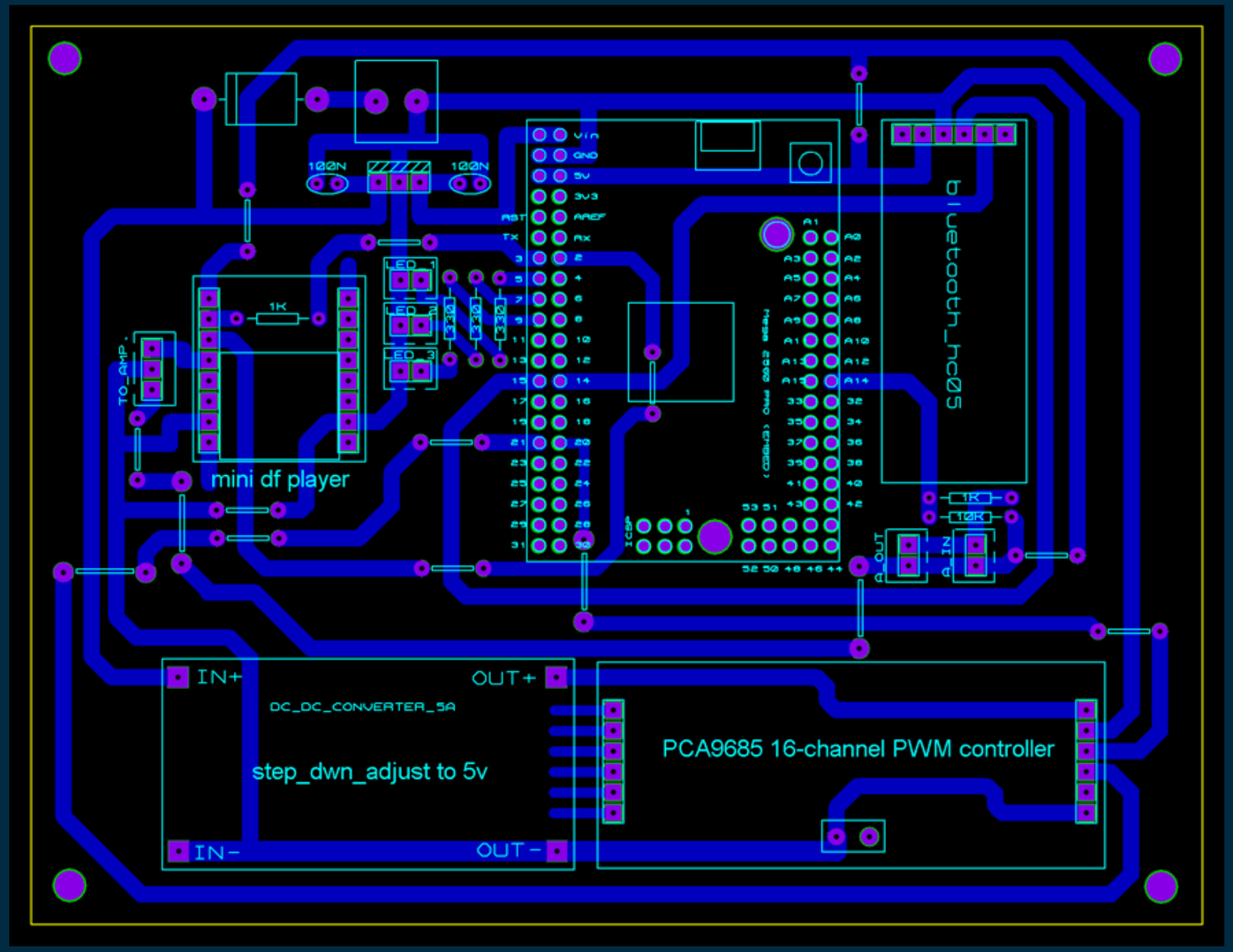


CIRCUIT DESIGN

- Arduino Mega controls all components
- Connected to:
  - Camera module for face detection
  - MP3 module and speaker for voice output
  - LED eyes for visual feedback
  - LCD screen for visual messages
- Powered safely with regulated voltage
- Designed to allow testing each part individually



CIRCUIT LAYOUT



PROGRESS MADE

- Defined our roles and how we work as a team
- Studied other robots and planned out what we want ours to do
- Built the face detection part using OpenCV
- Simulated the robot talking using Python
- Ordered all the parts we need and planned how everything will connect.

This gives us a strong foundation for next semester.

TIMELINE

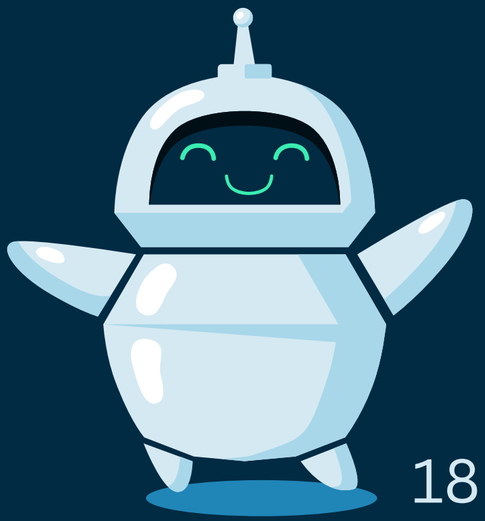
Weeks	Tasks
1	Project Kickoff & Role Assignment
2	Literature Review
3	Define Functional & System Requirements
4	Concept of Operation (ConOps)
5–6	Software: Facial Recognition Module
7–8	Integration & Logic Testing
9	Prepare Bill of Materials (BoM)
10	Simulation: LED, Audio Logic & Motion Flow
11	System Integration Plan
12–13	Progress Report & Presentation

NEXT SEMESTER TIMELINE

Weeks	Tasks
1	Component Inventory Check
2–3	Hardware Assembly (Wiring + Mounting)
4–5	Full Hardware-Software Integration
6	Add MP3 Playback Module & Audio Amplifier
7	Motor Behavior Implementation (Servo)
8–9	System Calibration & Error Handling
10	Real-World Testing & Refinement
11	Final Demo Preparation

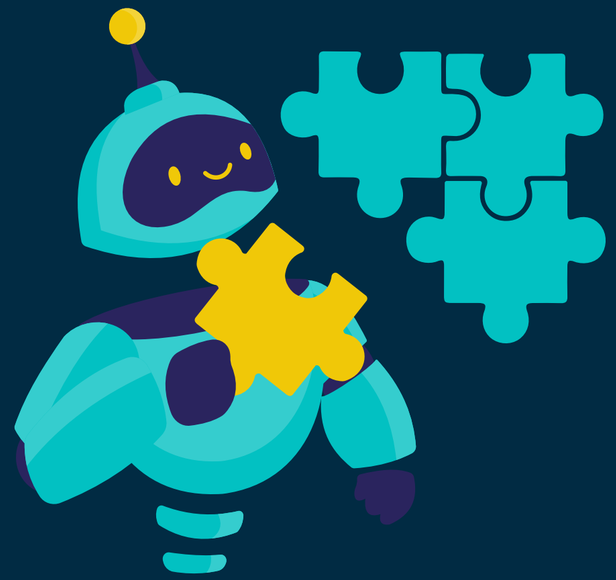
CONCLUSION

- Our robot helps students, faculty and visitors by giving voice directions and remembering returning users.
- It uses face recognition, simple hardware, and easy-to-understand software.
- We've made strong progress in ECEN 403 and are ready to continue building in ECEN 404.



REFERENCES

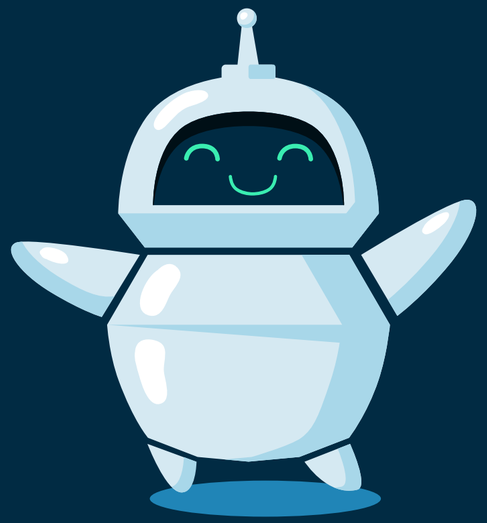
- Arduino.cc
- STMicroelectronics
- OpenCV.org
- Adafruit.com
- Python Speech Documentation

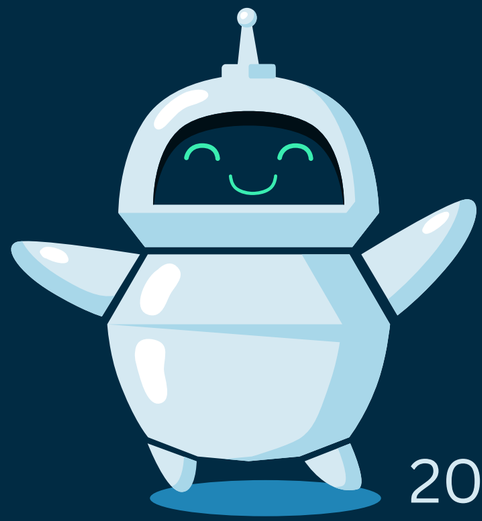


Thank you

for your attention !

Any questions?





To see how real users respond to our idea, we asked a reception staff member for their opinion.

Here is a quick reaction.