

CBM - Control Bot Mechanism

Modular Robot Head Prototype Device: Terbinari BPQ-1



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Overview

The Modular Robot Head is an innovative, artistic, and industrially designed robotic module that features advanced control algorithms, mechanical engineering, and electronic assembly. It is designed with a transparent face capsule and plastic casing, incorporating a bicolor LED square pixel matrix for displaying emotions and reactions through eyes, nose, and mouth animations. The CBM software and device facilitate interactive conversation via AI chatbot and artificial conversational entities, offering flexibility for adoption with existing chatbots and AI NLP systems like ChatGPT, primarily serving as an avatar.

CBM Control Bot Mechanism

The robot's control mechanism delivers a unique and engaging user experience, suitable for educational, therapeutic, and human-robot interaction research settings. Combining software and mechanical R&D, this initiative targets tailored solutions for therapeutic approaches such as Robot-Assisted Therapy/Training (RAT), addressing psychological and neurological conditions. The CBM robot head aims to explore educational and therapeutic applications through human-machine interaction.

Operating System Application Software Library Interface

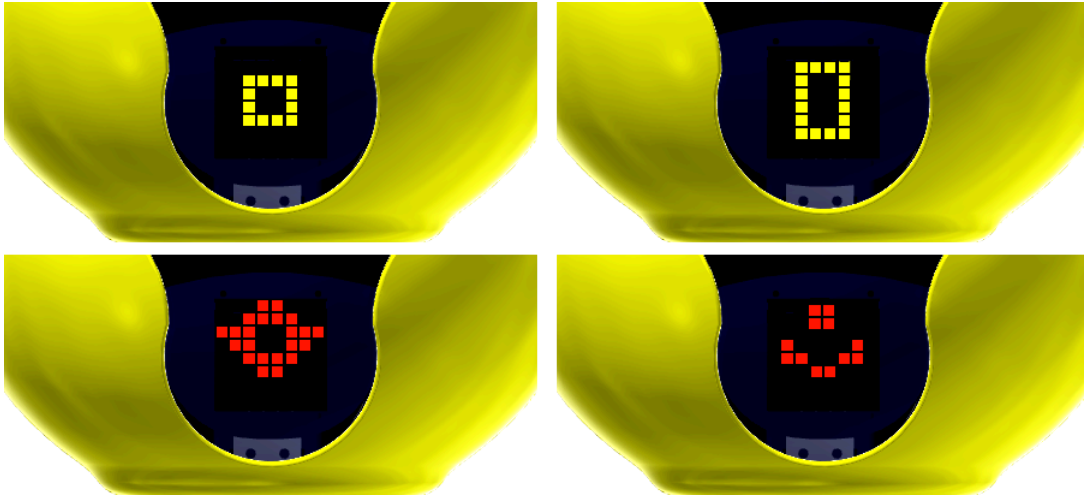
The Humanoid Robot software and device is a tool for interactive training and conversation. It is composed of a chat-bot interface and a humanoid robot control mechanism, which includes a cervical motility device for speech motion and facial detection/recognition. Its robot control mechanism provides a unique and engaging experience for users, making it well-suited for use in educational and therapeutic settings, as well as for human-robot interaction research.

Functionality

The CBM project presents a modular robot head capsule prototype with facial interactivity functions. The robot control device is powered by a 6V power supply and connects to the computer via a USB serial port. It comprises control software and a library of functions for a humanoid robot device.

Speech Animation with Visemes

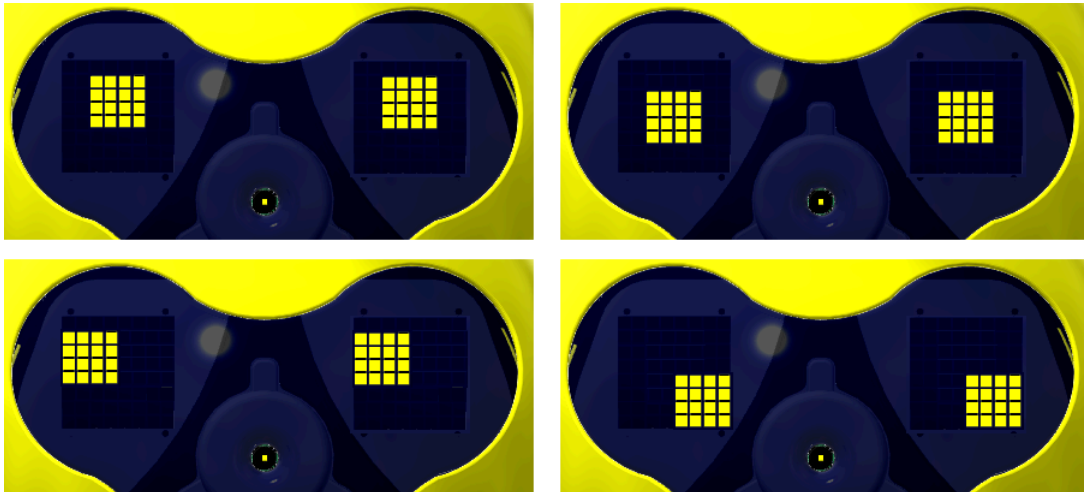
The control mechanism includes a Speech Viseme Motility Animation display for speech animation synchronization with speech lip motion, providing visual representations of phonemes (speech sounds) by synchronizing mouth movements with spoken words. It performs phonetically synchronized speech with mouth positions using 21 visemes according to the Viseme/Phoneme event set reference: [System.Speech.Synthesis.Namespace.SpeechSynthesizer.VisemeReached Event](#). The software is designed to be compatible with Microsoft Windows operating systems and requires speech synthesis/recognition references.



Face Detection and Tracking

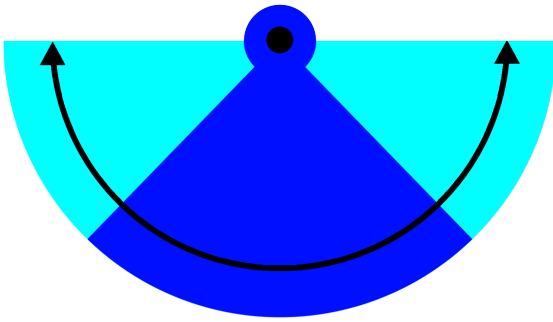
Facial detection/recognition enables computer vision face tracking/coordination with eye contact and head movement.

- **Face Detection and Tracking:** The integrated video camera inside the head capsule allows for real-time face tracking and coordinated head movement using computer vision.

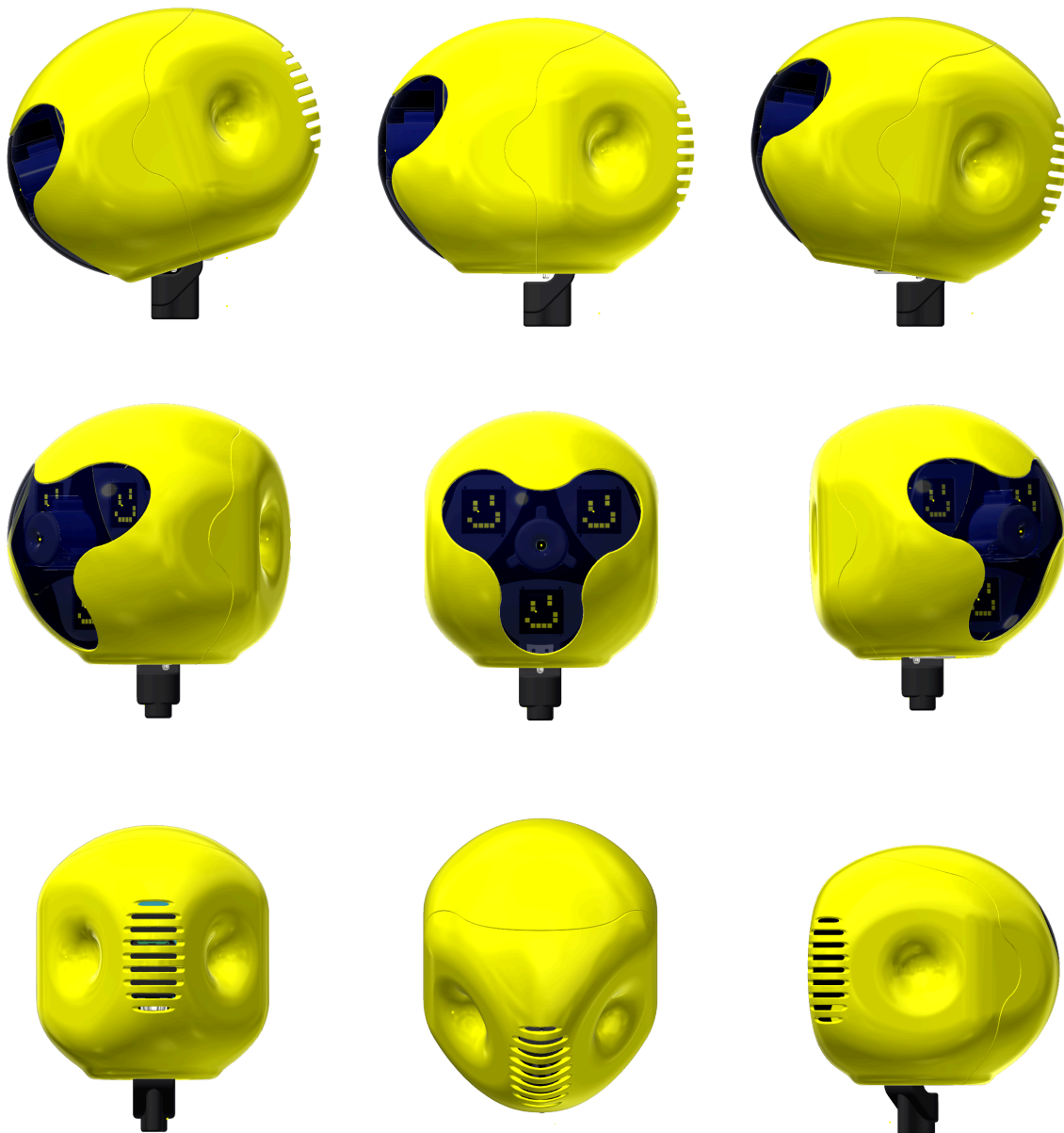


- **Eyes Gaze Following:** The bicolor LED square pixel matrix mimics the eyes of the robot, dynamically adjusting to follow the observer's gaze, creating an interactive and engaging experience.

The image illustrates the X and Y head movements of the Modular Robot Head. The central two blue quarters of the half-circle represent the zone where the robot's eyes track the observer's face and gaze. The turquoise quarters on either side show the area where the head starts to move, following the eyes' movements, until reaching the edge, which indicates the limit for body movement if tracking an object with vision.



- **Neck Orientation:** The neck movement mechanism is synchronized with the face tracking system, enabling the robot's head to orient towards the observer, enhancing the natural interaction between the robot and its user. Neck movement supports motion along both the Y and X axes, allowing for precise head movements.



Engineering Research Lab

Experimental Research and Development in Software and Mechanical Engineering for Artificial Intelligence, Robotics, and Design

Development Contributions

Lado Oniani is responsible for the conceptual design and original architecture, artistic industrial design, programming and control algorithms development, mechanical engineering, and electronic assembly of the Modular Robot Head Prototype device.

Contact and Support

For further assistance and support, please contact:

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Research Labs:

- [Engineering Research Lab](#)
- [Software Research Lab](#)
- [Game Development Lab](#)

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