THE UNIVERSITY OF CHICAGO
AxLab Actuated Experience Lab
† UEC

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Buoyancé

Reeling Helium-Inflated Balloons with Mobile Robots on the Ground for Mid-Air Tangible Display, Interaction, and Assembly

Introduction

We introduce a novel approach to mid-air actuated TUI by controlling helium-inflated balloons (HIBs) using mobile reeling robots. It features in safe touch interaction, scalable actuation, energy efficient levitation, and unique affordance.

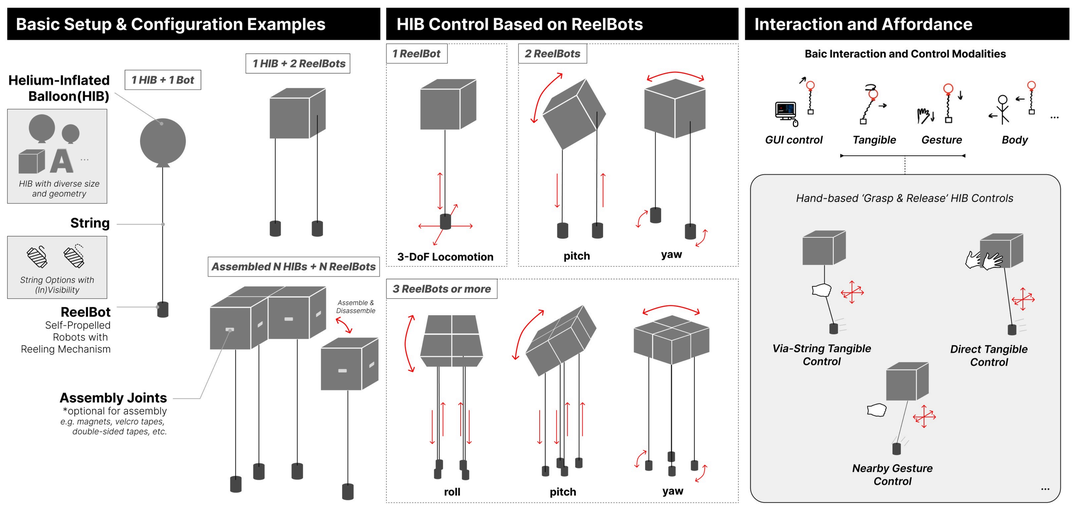

Figure 1. Design space of Buoyancé Capabilities

Applications

Information Display: Spatial Data Representation

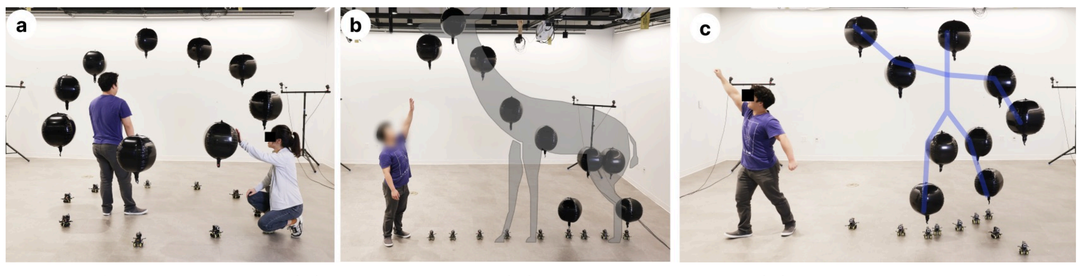

Figure 2. Representing (a) abstract data, (b) real-scale animal, (c) real-time body motion.

Assistive Room Configuration

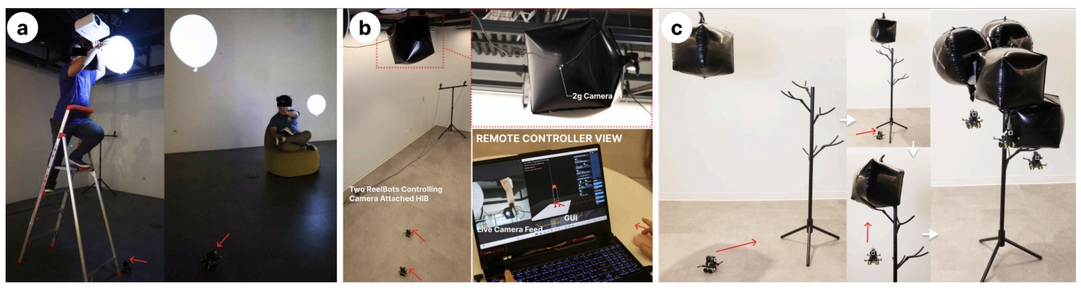

Figure 3. Configuring (a) mid-air lights, (b) remote camera, (c) sifted storage.

Mid-Air Assembly: Shape Formation of Texts & Characters

Figure 4. assembling (a) text formation, (b) interactive character formation

System Design

The overall system consists of ReelBots, HIBs, an optical tracking system (OptiTrack), and a computer to control the system:

- **ReelBots** are controlled wirelessly via Wi-Fi using the GUI
- **OptiTrack** (8 cameras) tracks positions and sends the data through Motive software to Unity via OSC
- Unity processes this data and sends it back to the Processing GUI

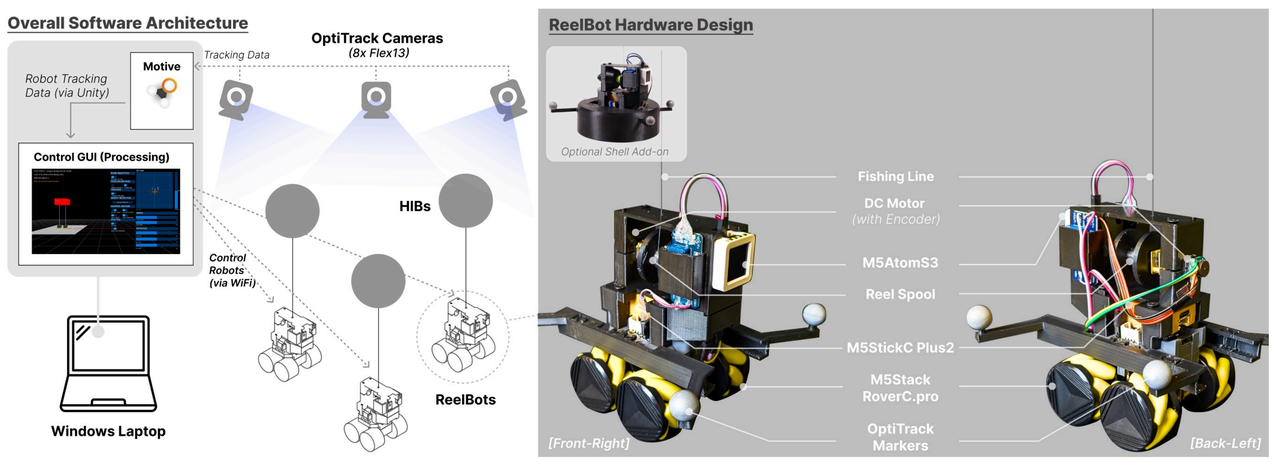

Figure 5. System overview of implementation of Buoyancé

Interaction & HIB Control Methods

Our GUI enables users to flexibly manage the XY movements of ReelBots and the Z-height adjustments of HIBs under various conditions.

Different Control Methods based on GUI: mouse control, joystick controller mode, data input control, hand and body based control.

Specifically, for body control, one method we explored is three types of **Hand-based 'Grasp & Release' HIB Controls:**

1. ***Via-String Tangible control*** grasp and drag the string to direct the robot and HIB
2. ***Direct Tangible control*** directly hold and reposition the HIB
3. ***Nearby Gesture control*** gesture-based manipulation

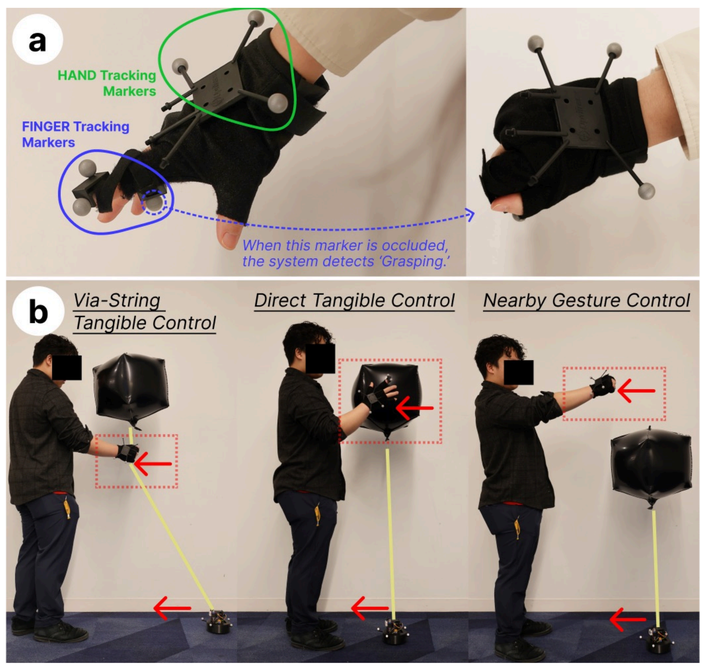

Figure 6. Controls enabled by tracking hand grasp and release movements.