Project Proposal
"HUEBERT"

A remote system for playing tabletop games

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2 INTRODUCTION

The following document outlines the potential project labeled as ***Huebert.*** Huebert is an interactive remote system which allows remote players (**RP**) to interact with present players (**PP**) in tabletop game scenarios. The inspiration scenario for the project follows,

> *A group plays a weekly game of Dungeon's and Dragon's, a game involving dice rolls, roll play, tokens, and maps. One of the group lives in a different household, and, due to the COVID 19 pandemic, is unable to meet in person with the other players. To continue the weekly tradition, the group has two options: move to an online environment if it is available; or implement the Huebert system.*

In the above scenario, the downsides of moving to an online environment follow:

- Increased limitation on game styles and environments (based on content available)
- No use for physical props and equipment
- Need for a computer system and decent internet connection for each player.
- Communication difficulties (voice/video chat)

The Huebert system would mitigate these disadvantages for remote tabletop gameplay by:

- Maintaining the game styles and environments of tradition in person gameplay
- Allowing players to use existing physical game pieces and props
- Requiring only the RP to have a capable computer system
- Improve remote communication from the RP by allowing gesturing with the Huebert manipulator

3 OBJECTIVE

The Huebert project will serve the following objectives:

1. Allow interaction and game play between PP and RP using physical tabletop game environments.
2. Offer an advantage over online gameplay.
3. Provide a RP with control and input comparable to a PP in the game environment.
4. Provide a fun and unique experience for the users.
5. Maintain the privacy and security of both the RP and PP computer and network systems.
6. Insure the safety of all users.

4 SYSTEM DESCRIPTION

Figure 1 outlines the Huebert system.

1. Sensors: An array of sensors and camera's which will give the RP input and data
2. Robotic Manipulator: A series of joins and motors which can manipulate a varied set of objects in the real world
3. Controller Hardware: A system of micro controllers, serial connections, and hardware drivers which drive the motors and sensors
4. Control Center and Network Interface: A single board computer (raspberry pi) which controls the motors and sensors and connects the system to a network
5. P2P Network: A peer-to-peer network established by Husarnet
6. RP interface: A laptop or similar which displays data for the RP and connects to a Network
7. RP controls: A control system which allows the RP to issue commands which are sent to the manipulator
8. PP display: A video and audio system which allows input and output of video and audio data to host communication between the RP and PP
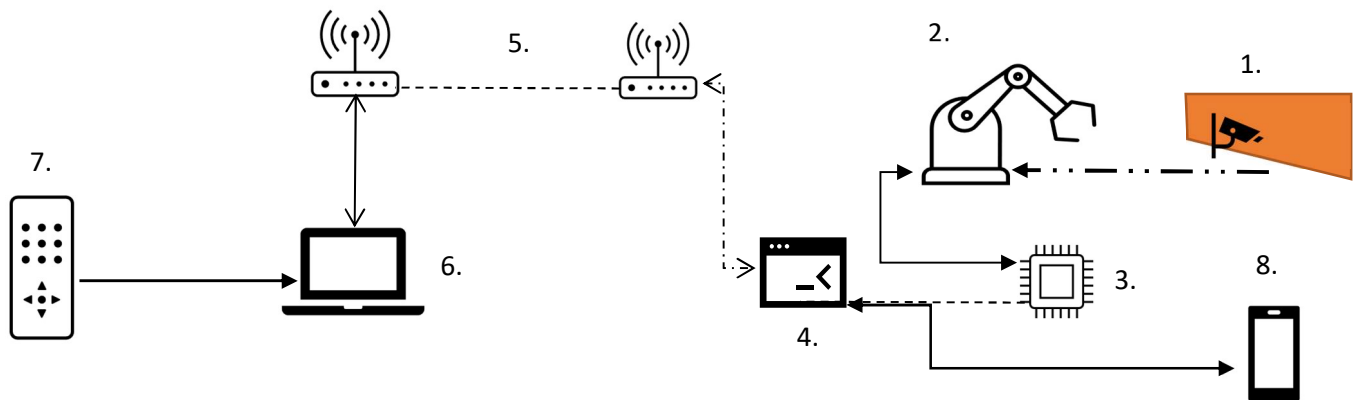

Figure 1: Huebert System Diagram

5 SPECIFICATIONS

5.1 ROBOTIC STRUCTURE

The robotic structure will be a 3d printed arm like manipulator. Off the shelf parts such as axles and bearings will be purchased from a supplier.

5.2 SENSORS AND ACTUATORS

Sensors will be incorporated into the robotic structure. They may include

- IR range/intensity sensors
- Ultrasonic Sensors
- Hall Sensors
- Cameras

The actuators of the system will consist of stepper, servo, and DC motors.

5.3 CONTROL SYSTEM AND NETWORK INTERFACE

Arduino micro controllers will drive the actuators and collect sensor data. There will be connected by Serial to a raspberry pi which will process, send, and receive data between the network connection and the hardware.

5.4 DISPLAY

A smart phone or equivalent display and camera will be needed for video chat purposes. However, this may be separate from the Huebert system.

5.5 NETWORK

The network connecting the RP to the control system will consist of a P2P (peer-to-peer) connection. This connects the RP computer to the raspberry pi directly, without a server. This service will be facilitated by Husarnet. Husarnet offers a software package and protocol to safely link devices together via their IPv6 address. This offers some advantages over server client connections including

- No need for a server, server manager, or server maintenance
- Lower latency
- Devices only need LAN connectivity
- Simpler setup since there are only two nodes in the Huebert Network,

However, this system comes with security concerns regarding remote exploits from a malicious user. Husarnet provides protocol to mitigate potential attacks, but more research and systems may be needed to protect both the RP and PP.

5.6 USER CONTROLS

The user control of the RP will consist of a custom controller of a keyboard and mouse configuration.

5.7 SOFTWARE REQUIREMENTS

All control software will be custom coded. Python will be used for the raspberry pi, while C++ will be used for the Arduino. MATLAB will be used for mathematical models and simulations. LINUX OS will be used for the raspberry pi and RP user laptop.