Project Title: A Cyber-Physical approach for remotely operating any computer using Hand Gestures

Motivation:

Many times we are a bit far away from our computers and laptops and need to control it or send some commands. For example increase or decrease the volume, change slides during the presentation, control the mouse, open applications, play small games, etc.

Currently, there are very few solutions available for this, and those that are available are expensive. Moreover, most of them support a limited set of features.

Proposed Solution:

We would like to design a Cyber-Physical Embedded system that consists of a glove with various sensors to track hand movements a processing unit to process the received data, a wireless network to send the data to the target and take actions based on movements.

Modeling:

We consider the values from different sensors embedded in the hand glove and track the direction the hand is moving in. Based on that we send signals to the connected computer and take actions.

Designing:

For tracking the motion of the hand, we will attach a hand glove which consists of a gyroscope and accelerometer. Two NRF modules present in both the transmitter and receiver are used as a means of communication for data. It will apply a sensing algorithm to recognize which direction the glove is moving. The receiver will receive this information every millisecond (in this case it's the computer). The data received will be sent through a python script which will perform respective operations. (like changing slides, increasing the volume, moving the mouse, etc.

The following diagram shows our design approach
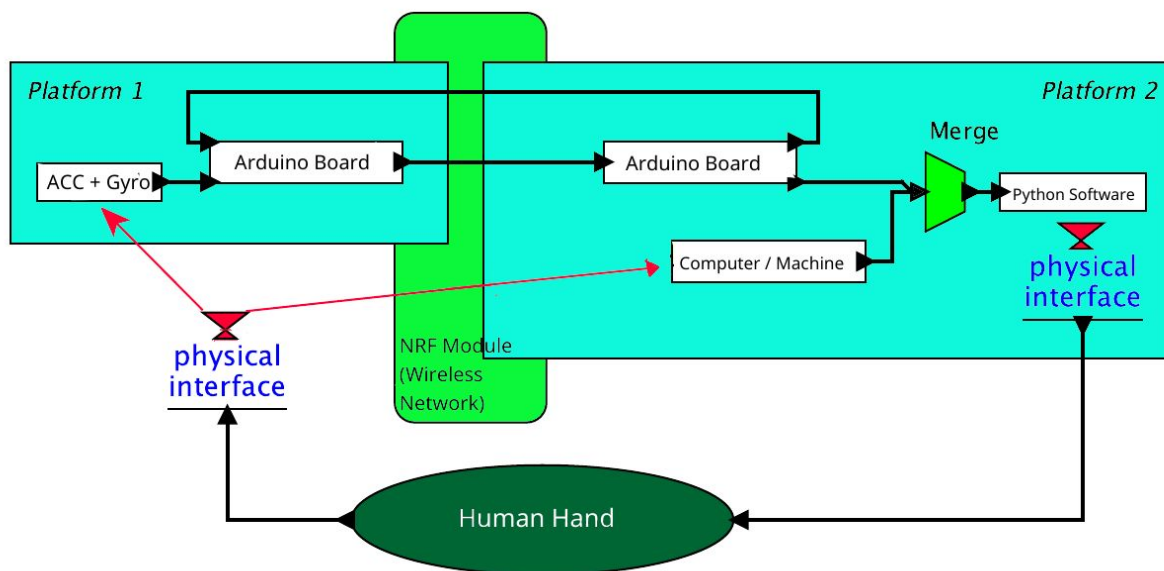
Analysis:

At the end, "A design without specifications cannot be right or wrong, it can only be surprising". Hence we will focus on relationships between models and analyze the behavior of the system.

This system has to interact with the physical environment continuously (the hand) and get the information about the movement which will act as an input to the model of the system. Since we are aiming for precise capture of movements, we also need to consider the physical properties such as acceleration in all directions (x, y, z-axis) and angle in which the hand is moving wrt all the axes.

Our implemented hardware design involves multiple embedded accelerometers and gyroscopes in the hand-glove to coordinate all the actuators accordingly.

Timeline:

1. Getting the sensor data values and building an algorithm to analyze the movements (2 Weeks)
2. Building a wireless transmitting network (2 Weeks)
3. Building a python module to take actions based on the data received (4 Weeks)
4. Integrating and testing all services (2 Weeks)

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