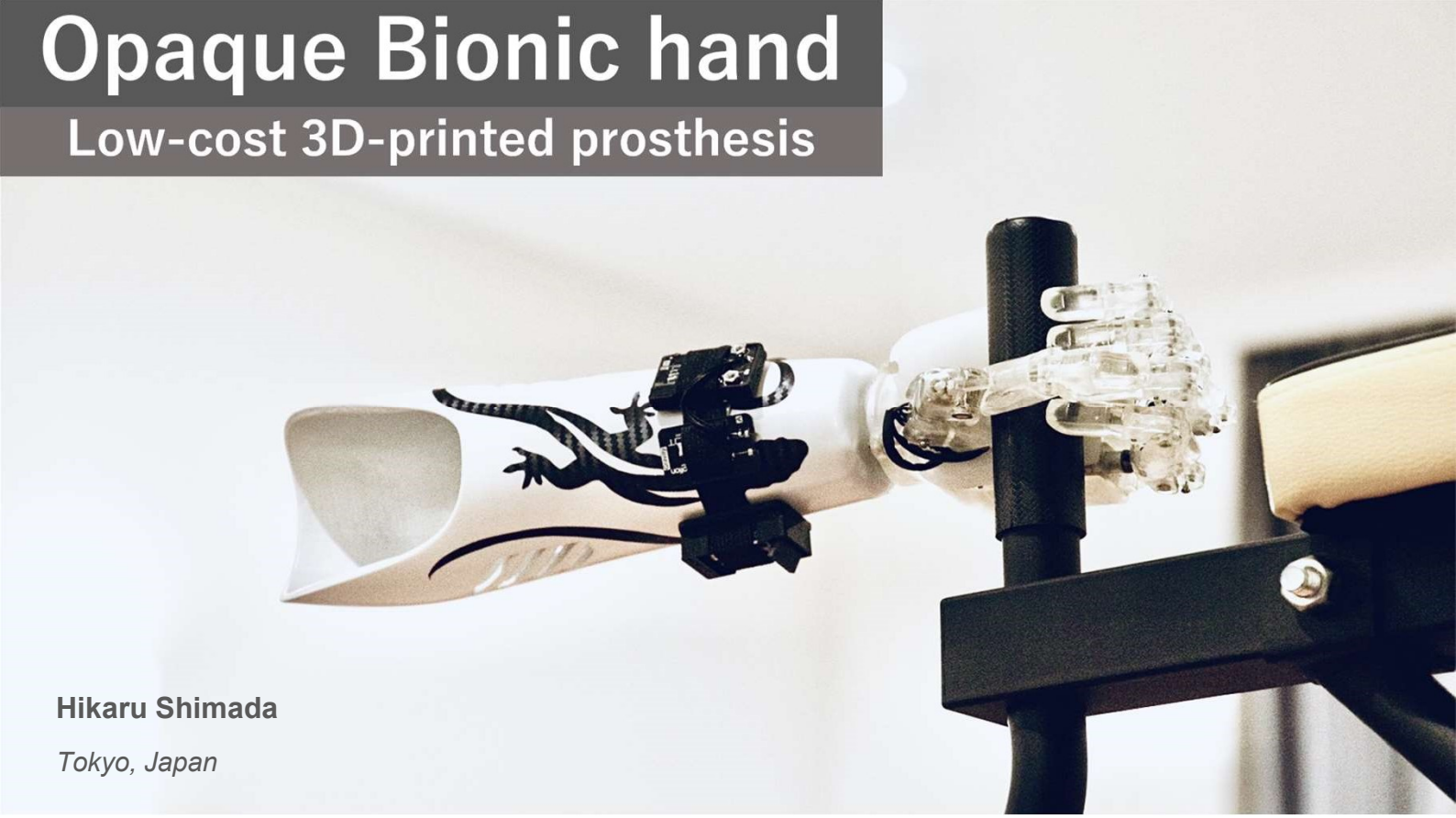
Opaque Bionic hand

Low-cost 3D-printed prosthesis



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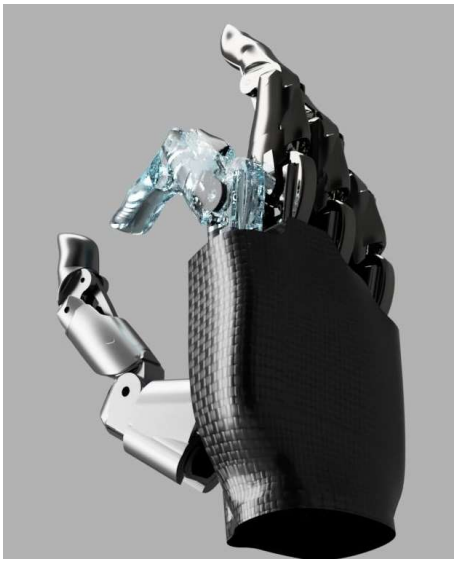
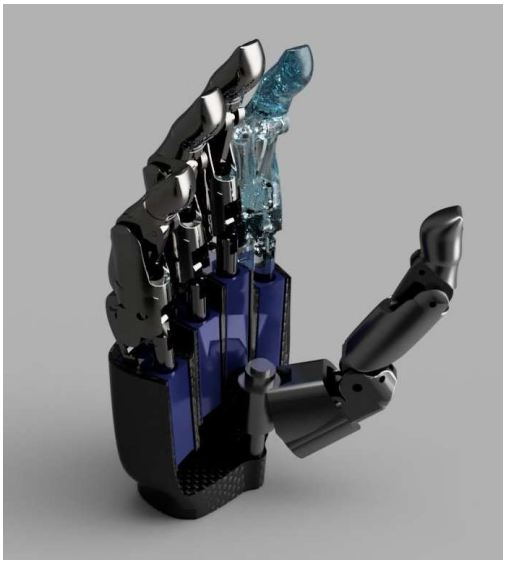
Basic purpose

The prosthetic industry is known as expensive and unaffordable due to all the devices are bespoke and utilizes advanced technology. Due to the complexity caused to create one device, it will end up costing not only money but the time for the user.

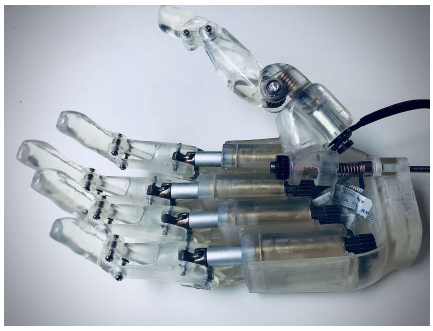
The opaque hand was created to fulfill the demand of the unwealthy users who are seeking quality, own it inexpensively, and without any worry of breaking the device. Furthermore, the hand is actuated using multiple EMG sensors which the users could train and use the model to identify different patterns to link with their desired movement patterns.



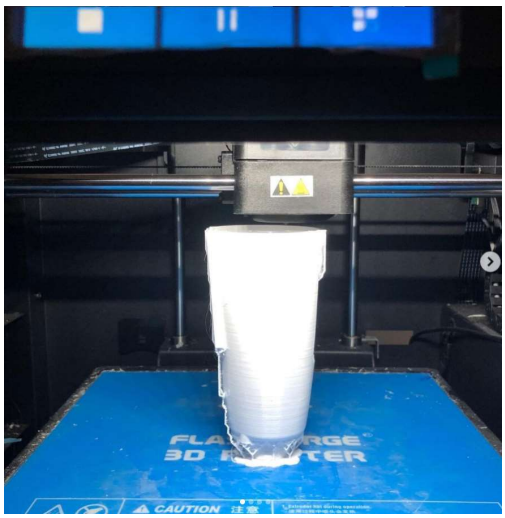


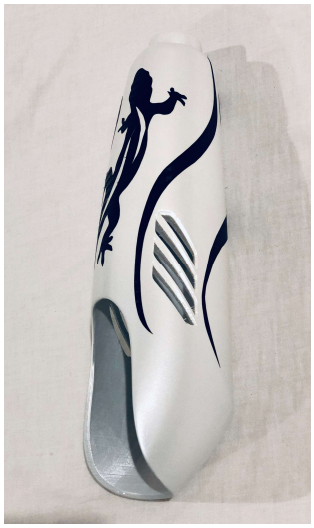
Overall specs of the prosthesis

The major difference between the conventional bespoke prosthetic hand and the 3D printed prosthetic hand would be the price and accessibility to the components. By creating the hand using a 3D printer, the manufactures side could reduce the time to produce and deliver, the user would be able to print their desired parts using the 3D file provided by the manufacture by themself. The easier accessibility to the components could not only reduce the cost of manufacturing but also, opens the issue of the bespoke prosthetic where all the parts are handcrafted.

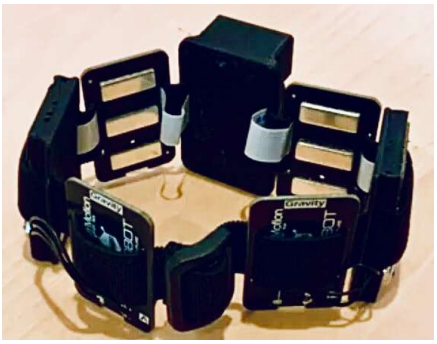


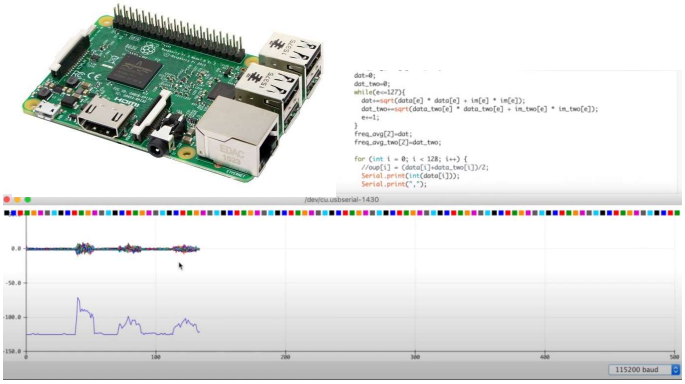
The main material used to build the prosthesis are mostly plastic resin and metals. The benefit of utilizing plastic resin instead of the full metal body like the conventional prosthetics are easily reproducible parts, weight reduction, decrease in stress from breaking due to its cost, resizing to look natural with another hand, and reduction in manufacturing cost. The socket of the hand could be 3D scanned using photogrammetry. This will reduce the hustle of creating a mold of the recipient's amputated arm. The data file could be then sent to the manufacturer which then will be 3D modeled and create data that is printable using a 3D printer.



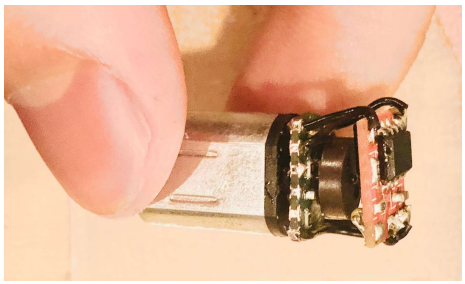


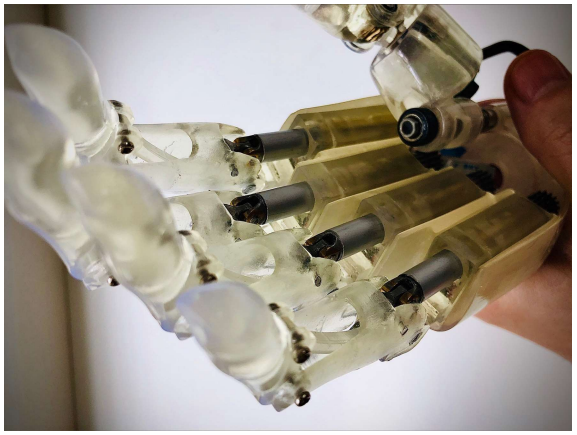
The hand is actuated using microcomputers (Arduino and Raspberry pi). By utilizing cheap electrical components that could be easily purchased in online shops, the overall price to manufacture the hand could be reduced. In order to select the mode that the user has desired, users could create their own recognition model on raspberry pi hidden inside the arm using the data fed from 4 EMG sensors. The model created will be used to identify different modes that the user has pre-trained to select the desired option to actuate the movement on the prosthetic hand.





The major issue when prototyping was the strength of the fingers. In the past prototypes, fingers were actuated using plastic micro servos which have created energy loss, noise, and not enough power. The solution to the issue was solved by creating a high torque microactuator using a 3D printer. This technology has allowed the hand to stay compact but be able to carry more than the weight of the hand itself.

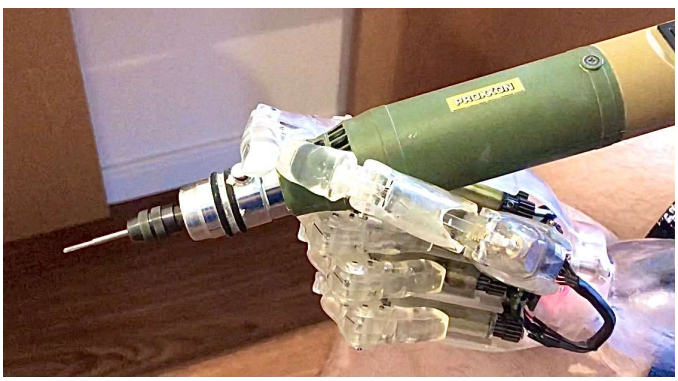


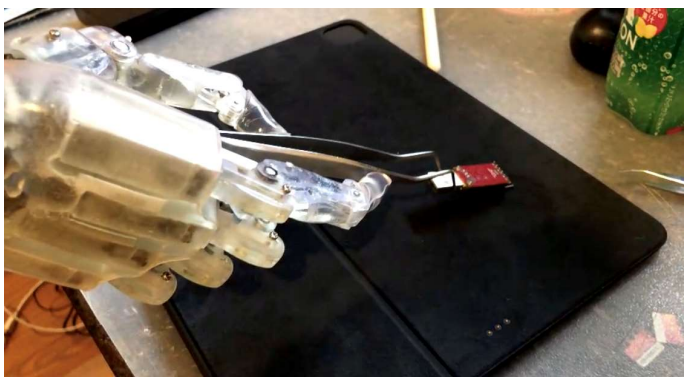


Background information

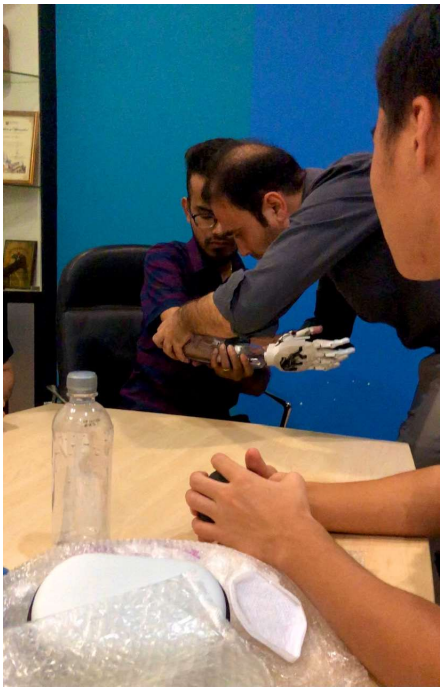
Currently, in Japan, there are roughly 200 requests annually for myoelectric prosthesis issued by Japanese citizens. Despite its demand, only 2% would be accepted due to its cost. This is statistics in Japan which is known as having a relatively high-income rate globally. The reason behind this would be the users are required to have valid reasoning and approval from the insurance and the government in order to purchase the devices. This is due to the significant price due to the research and manufacturing cost which would range from 5,000 USD to 30,000 USD each.

Another reason would the motorcycle accidents which are often seen in developing and developed countries due to the creation of paved roads. Motorcycle accidents have a high rate of amputating limbs when in severe accidents compared to car accidents. This could be backed up by the motorcycle death rates in 2020 in Japan which has consisted of an overall death rate of 21% (510 citizens in Japan).





In the past, we have collaborated with the University of Malaya (UM) to request feedback on the past prototypes from 2 patients. The responses were taken and the current prototype was created. The issues were the size, weight, usability, and look.



Rough cost

The key feature of this 3D printed prosthesis would be its price of the materials used. 3D printing UV resin would cost 30 USD, metal components would cost around 50 USD, electrical components excluding raspberry pi (14 USD) and EMG sensor (30 USD each) would cost 20 USD, and a mobile battery which will cost in the range of 10 USD to 30 USD.

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