Plan Outcome

An issue which I will seek to resolve is how some people have stiff shoulders, leading to an inability to scratch their back, which increases stress levels. An outcome I will seek to create to fix this is a wearable electronic back scratcher.

The implications of this outcome include:

* Intellectual Property – The outcome should consist of systems which I have the right to use, whether they be free to use or have fees I have paid for
* Usability – The control interface for the backscratcher should be intuitive and easy to use
* Functionality – The backscratcher should have full back reach
* Health and Safety – The back scratcher shouldn’t inflict any injuries onto the user, such as colliding into the back with high power
* Accessibility – Wearing the apparatus shouldn’t be complicated
* Aesthetics – the apparatus shouldn’t be off-putting in its appearance
* Sustainability and future-proofing – The apparatus should be made of material which is as unharmful to the environment as possible. The code should also be easily updatable and the apparatus itself should be easy to repair in the event of damage

Requirements:

* The resources will consist mostly of systems which I already own and therefore have the right to, and any other resources I will obtain legally
* The app which I am planning to control the apparatus with must be self-explanatory
* The apparatus must be capable of moving in 3 dimensions for full back reach and pressure
* The apparatus must not be capable of forceful movements
* The apparatus must involve as few straps or other means of mounting as possible
* The electronics of the scratcher should be as hidden as possible
* The main material of the apparatus must be easily recyclable or biodegradable
* The apparatus should feature a clear port to access the microcontroller for updating code
* The distinct moving parts of the apparatus shouldn’t be permanently connected, for easy maintenance

Communication Protocols, Components and Subsystems:

* The outcome will be a robotic arm mounted at the back of the neck, which will extend to reach throughout the back. I find this to be the best method of satisfying the outcome as it will make the apparatus easy to wear, being attached at only one point.
* The apparatus will be controlled by a smartphone app, which will have buttons for moving the arm in three dimensions. I find this to be most suitable as it gives the user precise control over where exactly they want the arm to be and how much pressure to apply.
* The head of the arm will have a blunt point, with the ability to perform small movements to satisfy an itch. I chose this as the best design for the head as it is not sharp, reducing risk of harm, while also having a full ability to satisfy the user.
* Bluetooth will be used as the communication protocol between the smartphone and the apparatus. This is because it can send information quickly at short distances with no existing network.
* The arm itself will move by use of multiple servo motors, enough to precisely reach all regions of the back, and the head will have its small gyrating movements controlled by a motor
* The processing and control of the motors will be done by an Arduino Uno microcontroller with a Bluetooth module for wireless communication. This is because it is a small microcontroller with all the connection potential I need, without being unnecessarily advanced.
* The apparatus will be powered by the USB output of a power bank. This is because it is rechargeable, and therefore less wasteful than batteries, and will also be inexpensive during testing as I already own one.
* The main structural material will be 3D printed PLA plastic. This is because it is corn-starch based and therefore has a minimised effect on the environment while still being structurally secure, and is 3D printable, so I can make specific designs to suit my production needs.

Purchasing Components

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Component | Quantity | Specifications | Source | Description |
| Servo Motor | 4 | High torque | [AliExpress](https://www.aliexpress.com/item/32854187745.html?spm=2114.search0104.3.2.5b8c7be6pAJqcU&ws_ab_test=searchweb0_0%2Csearchweb201602_4_10065_10068_10547_319_10059_10884_317_10548_10887_10696_321_322_10084_453_10083_454_10103_10618_10307_537_536%2Csearchweb201603_52%2CppcSwitch_0&algo_expid=a591820d-2441-43ee-a355-40a0531c66a6-0&algo_pvid=a591820d-2441-43ee-a355-40a0531c66a6) | Will be ordered early in the project to allow for delivery time. |
| Motor | 1 | Average torque | [Jaycar](https://www.jaycar.co.nz/search?text=motor&CSRFToken=b775d0da-ed44-49d9-8e12-49545f7dcd35) | Will be bought locally, despite the higher price, as it is needed earlier in the project and the price is still not very high relative to buying the servos locally |
| Bluetooth module | 1 | Ideally an HC-05 module as I have found a tutorial for this | [AliExpress](https://www.aliexpress.com/item/32612978653.html?spm=2114.search0302.3.2.42d854f2I8m6qD&ws_ab_test=searchweb0_0%2Csearchweb201602_0_10084_10083_10547_10887_10307_321_453_10548_322_454_10618_536_10065_317_537_10068_319_10059_10103_10884_10696%2Csearchweb201603_0%2CppcSwitch_0&algo_pvid=4421341d-e40d-40cc-9508-1ba77394714a&algo_expid=4421341d-e40d-40cc-9508-1ba77394714a-0) | Will be ordered with the servos, once again to allow for the lengthy delivery time |
| Power Supply | 1 | Will need a certain voltage and current rating | Already owned | Once I have finalised a design, I can select from power supplies I already own (battery packs, power banks etc) which meets the design’s requirements |