1.

Hi, my name is Yaya Lu. I am a Grade 10 student from Ogilvie High School in Tasmania, Australia. When I heard about the difficult living conditions of a Complete Quadriplegic in Northern Tasmania, I decided to see if I could produce something to help Complete Quadriplegics in their daily lives.

2.

A Complete Quadriplegia has no ability to control their arms and legs, often caused by a break in the spinal column above the C7 vertebra.

DON'T USE VIDEO

3.

A complete quadriplegic relies almost entirely on others. Could I do something to give them more independence?

DON'T USE VIDEO

4.

I designed two head-mounted control system prototypes that can control two prototype wheelchairs, and suggested a potential personal assistant for the quadriplegic.

5.
All components have local intelligence, built in the LEGO Mindstorms NXT computer bricks, which permits them to be plug-in replaceable components.

6.
The first headset control plug-in component detects movements of the parts of the face.

7.
The second headset control plug-in component uses voice control, using variations in sound.

8.
The common control protocol defines a series of standard control commands (in characters) that are sent from the headset control units to the wheelchairs.

9.
The first wheelchair prototype is a standard 4-wheel wheelchair with an experimental chair-lift feature for convenience.

10.
The second wheelchair prototype is a wheelchair that uses 8 experimental multi-directional “holonomic” wheels.

11.

I have also prototyped a plug-in automatic shopping trolley that I hope to develop into a personal assistant in the future.

12.

I have decided to use LEGO Mindstorms NXT to prototype my control system because of the versatility this system offered.

DON'T READ WHOLE SLIDE.

13.
So for the first headset system, what parts of the face can we use to control a wheelchair?

14.
I decided to use HiTechnic sensors which use pulsed light to measure distance, because these are relatively insensitive to changes in ambient light.
DON'T USE VIDEO.

15.

I could not afford a full-size wheelchair, so I prototyped my wheelchair using LEGO NXT MindStorms.

DON'T USE VIDEO.

16.

READ BEFORE VIDEO: How can I send a signal from the headsets to the wheelchairs?

READ AFTER VIDEO: These sensors are known as NXTBee sensors; and have a range of about a kilometre.

17.

A lot of factors were considered when deciding on the different facial features we could use for the control system. Eventually, we decided to use the following facial features to control the wheelchair.

So how can we use facial movements to control a wheelchair, for example, using the eyebrows?

18.

But what about human ear movement? Is that even possible? READ TEXT BOX

19.

So does this mean there are genetically inherited limitations to human ear movement?

READ TEXT BOX

20.

READ TEXT BOX

21.
So how would we be able to use ear movement to control a wheelchair?

22.
Then we have to consider the beauty aspects of this design. LEGO pieces are quite good as a prototyping system, but its big and bulky pieces can be quite inconvenient to wear. It is not a great fashion statement either. So can I suggest a better alternative?

23.

Unfortunately, there are also cases of people with limited muscle movement, such as Lou Gehrig's Disease, which renders the first control system difficult to implement. So then we considered using voice to control the wheelchair, which is the second control system.

24.

I considered using Morse Code, a famous method of communication by using a fixed code. However when I implemented part of Morse Code, I found that the variable length of the code command strings meant that the short signals "dit" and long signals "dah timings, plus the three different exactly defined lengths of silences between the dits and dahs were too exact for the testers to use easily.

25.

I then considered the Chinese Telegraph system, which was a code that had fixed-length command strings. Four; grouped using the code book page number, column number, line number).

I incorporated this idea into the system, and added a calibrating timing threshold to distinguish between the short dits and longer dahs. Adopting this change allowed me to make the lengths of the command sounds easier to learn.

26.

This is how I implemented a control system based on the variable length sounds.

27.

The second prototype wheelchair I built, used multi-directional “holonomic” wheels… CONTINUE

28.

CONTINUE FROM PREVIOUS…And it looked like this. As you can see, there are eight holonomic wheels, two on each motor.

29.
So how would this wheelchair work?

30.
Then we need to consider how we could toggle this control system on or off.

31.
The difference between this control system from others is that it is not just limited to voice; it can be used with any type of signal that is of varying length.

32.
I then implemented a prototype plug-in automatic shopping trolley that I think has the potential to help a paraplegic.

33.
In the future, I believe this has the potential to be developed as a personal assistant for a complete quadriplegic.

34.
My prototype shopping trolley looks like this.

35.
So how would this system be prototyped, and would it actually work?

36.
In the future, how could we implement this system as a personal assistant for a quadriplegic?

37.
Then for health and safety reasons; how can we make sure the wheelchair is safe to use?

38.
So finally, what have I proposed, and what I have achieved in this investigation?

39.

Thankyou for listening. ☺

Are there any questions?