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How Robot Disassembly Technology going to subverts the E-Waste recycle Industry .

<How E-Waste is processing now >

Traditional way

Below data does not include those is good for resale

1. **Land fill**

   According to EPA report , about 75% of E-Waste is land fill in the US , when the E-Waste got oxide , it release lot of toxic element , which is really harmful to the environment . Even though every body knows it but due to lack of incentive and law enforcement , this is going to be carry on for a while .

2. **Shred**

   About 5% of the collected E-waste is shredded, The shredding machine need big amount of investment and maintenance, meanwhile the output value is low , mostly it happen when recycler is paid to shred it .


3. **Sale overseas**

   Unfortunately, most of the E-Waste collected were sold overseas , 90% and above , it is quick money and clean for the US but it also create garbage in the other country thus many criticism occurred .

4. **Hand disassembly**

   Less than 1% of the collected E-Waste is hand disassembled due to its high cost , only two condition it is done , either the machine have very high component value and smelter value or supplier paid to destroy it .

5. **New way Robot disassembly**

   Less than 1%E-Waste collected is robot disassembly, We have been promoting robot disassembly for 3 years in all the Recycle show , there is too many advantage in Robot disassembly , especially with the AI help , it will ultimately subvert the E-Waste recycle industry .

<What is the difference >

E-Waste five value element

1. **Plastic**

   Plastic occupied 20% weight of the E-Waste, and only 17.4% E-Waste plastic have been properly reused , if you shred them , only 60% of them is recycled because now day technology limitations. But if you disassemble it by robot, you can get 98% recycled and it is clean plastic. A shredded mixed ABS can sell 0.1usd /Labs but a pure pull single type ABS plastic can sell up to 0.25usd /Labs. Also , you can reuse the plastic directly into new product without the double melting process , you can reuse with less smell and carbon dioxide emission .

EPA set a goal to recycle 50% plastic in 2030 , this is the easiest way to reach target .

2. **Battery**

Battery recycling now is a new industry, all the recycle method pull it out , the only difference shredding company they hand pull the battery ,labor cost is not cheap , robot disassembly battery is pull by robot so cost is lower .

3. **Pcb board**

PCB is a high value target of E-Waste, after smelting process , you can get valuable metal such as copper , gold , silver , platinum , aluminum and some other precious metal . If robot disassembly it, you will get a complete board , the board value is properly kept but if you shred it , many percentage cannot be recovered due to sorting process . Our recycling industry has a joke , spend one million to shred it and spend another two million trying to separate it back .

Also, remember precious metals such as gold and platinum , will vapor in the air when shredding .

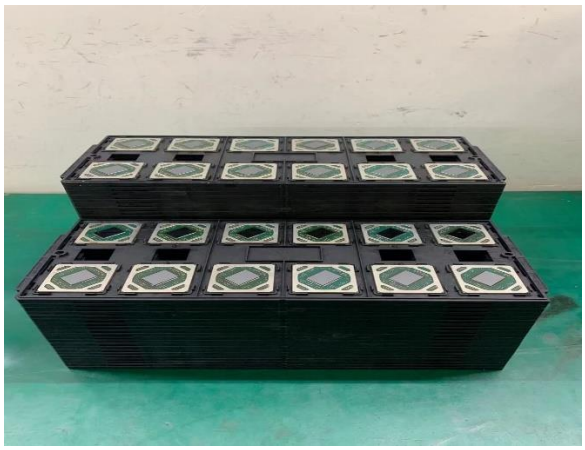
4. Metal

Most of the E-waste have metal attached to it for multiple

purpose ,such as heat dissipation (heat sink), electric power supply (power core),if robot disassembly , most likely you can get 98% of it but if shredded , everything mixed together , you may get 70% if you are using very high end sorting machines .

5. **Chip Value**

   Chip harvesting been very hot for these few years, mostly it is done in Malaysia and China , 7 years ago when I start to promote this idea in the US , not much people take it serious but now day , most of the big recycle companies had independent department to do it . If you shred it of course you got nothing . if robot disassembly it , you get good chip but not all because some chip value is too low that can not even cover the robot cost .



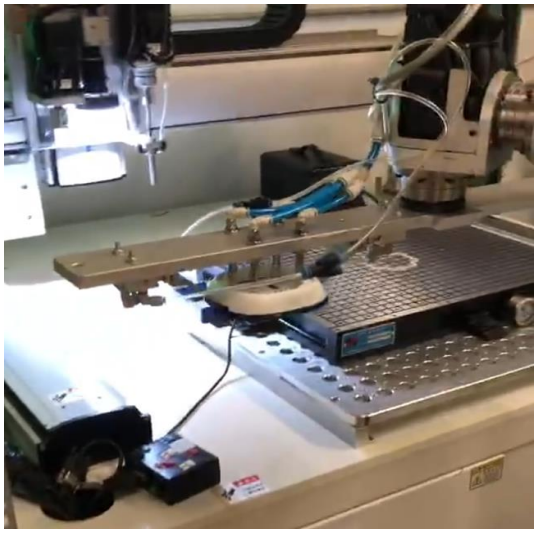
	Plastic	Battery	Pcb board	Metal	Chip Value
Land fill	0	0	0	0	0
Shred	60%	98%	60%	70%	0
Sale overseas					
Hand Disassembly	98%	98%	99%	99%	98%
Robot Disassembly	95%	98%	98%	98%	95%

<What Robot can help in the E-Waste recycle Industry >

1. Disassembly

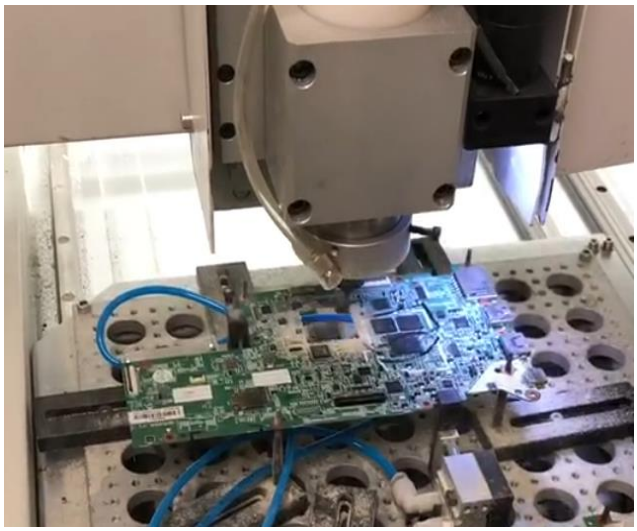
Now we are largely disassembly the Chromebook and Router.

Anything identical, big quantity can take advantage of robot disassembly .



2. **Chip harvest**

   Now in Malaysia and China, there is more than 200000 person doing chip harvesting day and night (according to CRA report), recycler in US knows but cannot do much about it due to high labor cost in the US but with the help of Robot it is doing quite good now in the US .



3. **Chip refurbishing ,testing and packing**

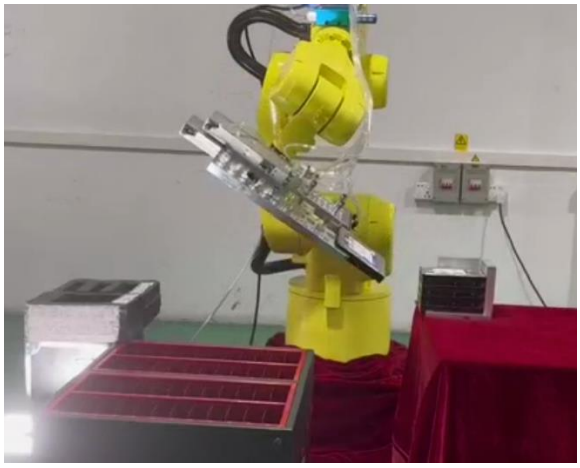
This is little related to above topic but different , the harvested chip need to be tested then can sell , same old problem , US labor cost too high , but now robot can do it .But there are much more then this , there are so many surplus chip which is storage for a long time , before they can be reused , it had to go through the reball andretest procedure , of course , robot can help .

Not to mention that reuse hard drive, laptop , server and routers . All robots are good at it.

4. **Data Wiping**

   AI and IT cloud services are run in data center , and most of the hard drive they use is big capacity like 4 T , 6 Tand 10 T . To wipe an single 10 T hard drive, take 22 hours , and there is more then 100000 hard drive to wipe a month , how terrible labor cost it

is ? Robots can do a good job .



5. **Metal separation**

In our E-Waste industry, you will always get lot of item related to E-Waste but it is metal, with the help of sensor and robot you can easily separate it out and maximize the value out of it .

For example, if aluminum mix with copper , if you smelter with copper temperature , you don't get aluminums but if you sort it before smelting then you get both aluminums and copper .

6. **Storage**

   For the big recycler, storage maintain and operation is a heavy cost of labor , with UAV robot help , you can condense the storage space and speed up the pallet cargo flow inside the facility , AMAZON set an good example .

<Why Robot disassembly is so important >

1. **Keep resources inside USA**

   Metal resources is crucial for any country such as copper, aluminums and gold, if E-Waste is sold to Malaysia, then the resources will be belong to China , 98% of the recycler in Malaysia is belong to Chinese .

   If E-Waste can be disassembly inside the US with affordable labor cost, then US hold the control of it .

2. **Creating extra 40000 job position inside US**

As I mentioned above, more than 200000 person is doing chip harvesting in Malaysia and China , if we can do it in the US with the help of Robot , then lot of job position is created , but we don't need that much people because we have robot .

By the way, robot don't robbery job position with US citizens because without the help of robot , such job position is not exist in the US . Every 4 robot needs a human mother to take care of it for common operation.

3. **Data security**

   For example, set top box are so popular in the US, some are mechanic hard drive and some are SSD , most likely 500G or 1T , resell value is too low , they are sold to overseas , but now with the robot help , it can be wipe within US with very low cost , so US citizen personal intelligence is protected .

4. **Prevent product reverse back to market**

   Some of the E-Waste suppliers don't want it back to market , robot disassembly can efficiently disassembly it inside the US with low cost within supplier surveillance range , so it will not

reverse back to market .

5. **Chip shortage**

   In the Covid time, people have to work from home , chip maker don’t have worker to produce chip and remote work required a lot of device such as laptop and desktop computer , in the period of time chip price is minimum double or triple . If used chip is harvested, especially in the US , this can largely reduce the shortage problem , also many old device need old chip to repair , chip maker will not restart machine for 1000 or 2000pieces of chip , Chip harvest is the only practical way .

6. **Keep profit in the US**

   If precious metal and chip is harvested within the US , the money is in the US but if it goes to Malaysia , profit is in the pocket of Chinese .

<What is the challenge for Robot disassembly>

1. **Valuable chip or Tantalum recognition**

   Tantalum capacitor on the Pcb board and chip recycle value can fund the robot operation but there are so many chip on the

board, how to tell which one worth to harvest ?

2. Supplier side help

   Many supplier believe their device is recycled in the US but the truth is 90% are sold overseas . Supplier need to really think about this seriously. The simple way to figure it out is Prove of profitability .Ask downstream to show the excel file of the recycle material value , shoot a photo of how they recycle it (labor cost) . It is easy to tell that, the recycle material value is less than the labor cost ,nobody is willing to loss money in a long term , in the end it is sold overseas . If they have robot help, they have the chance to process in the US . Need supplier to start aware of this.

3.3D device structure

The shape of the device structure is getting more and more

sophisticated, for robot, it is getting more and more difficult to disassembly it if it is 3D structure .

4.Government role in collecting

Robots can have a big advantage when item is identical and big quantity. This will need the help of government.

For example, if you use the service of Verizon or Spectrum , you need to pay 100 usd deposit for the router you use , when you want to move house and use other service providers , you have to return the router back to Verizon or Spectrum , then Verizon and Spectrum have identical and big quantity device now .

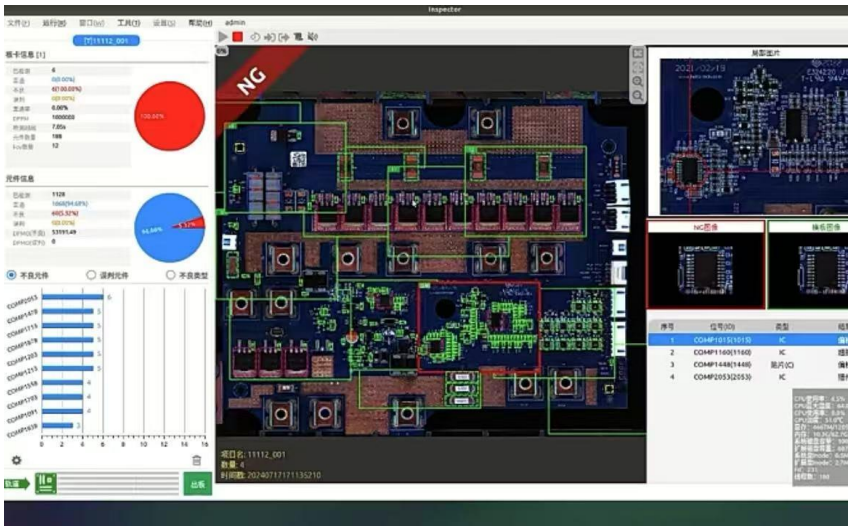
Government can enforce such good policy for most of the electronic Devices, you will see a thorough change of E-Waste industry , land fill rate will reduce dramatically .

<How AI is going to help Robot in E-Waste recycle industry >

1. **Computer vision**

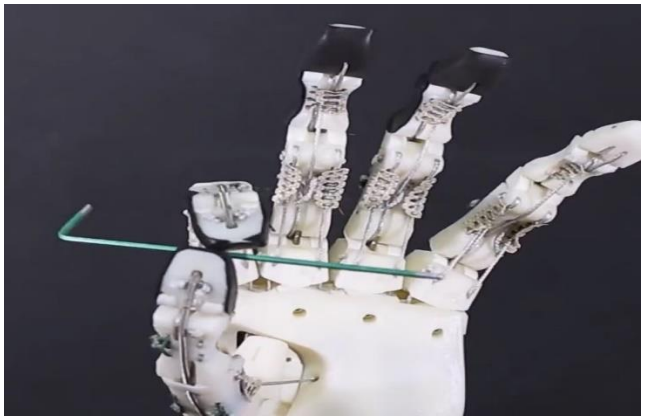
   When we do the robot disassembly, we often encounter problem like screw position slightly change because device version upgrade , chip harvesting is difficult to recognize the

text on the chip body . This can be largely improved by trained AI computer vision.



2. **Jig**

When you process the E-Waste, you will always need all kind of JIG to hold the item you want to process , with the AI help , you can have universal JIG to hold the item , so you don’t have to make so many model of JIG .



3. **Material Analyzing**

AI now can integrate all the data from the robot and sensor, by more and more training to AI , it will be able the robot do act more precise and efficiently in just a second . This can not be done by human being before .