**Appendix D: Table of inventive principles and schemes**

**Table** Inventive principles and schemes

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| **Inventive principles** | **Explanation** | **Scheme** |
| 2 Taking out-separation | ①Isolate "interfering" parts or properties in an object.②Extract only the necessary parts and attributes of an object. | 1 The sensors are activated in a time-sharing manner in a prescribed order to reduce the mutual influence of the echo signals. |
| 18 Mechanical vibration | ①To vibrate or oscillate an object②Increase vibration frequency③Use the resonant frequency of an object④Replacing mechanical vibration with other forms of vibration | 2 Use sensors with different frequencies so that the sensor can only recognize its own signal with a unique frequency |
| 27 Cheap short-living objects | Use low-cost, less-durable objects instead of high-cost, durable objects | / |
| 35 Parameter changes | ①Change the physical state of the system②Change concentration or density③Change flexibility④Change temperature or volume | / |
| 1 Segmentation | ①Break down an object into separate parts②Make an object easy to disassemble③Increase the degree of separation | / |
| 10 Preliminary action | ①Pre-use objects partially or fully to produce desired changes②Pre-position objects so that they can be used immediately from the most convenient location | 3 The mechanical structure is installed, so that the distance between the sensor and the workpiece is within the optimal measurement range for each measurement. |
| 28 Mechanics substitution/another sense | ①Replace mechanical systems with light, sound, and heat systems.②Use electricity, magnetism, and electromagnetic fields to interact with objects③Convert the static field into a dynamic field, from disordered field to ordered field, so that the field changes in time.④Combined field active particles use field. | / |
| 34 Discarding and recovering | ①When a component completes its function or becomes useless, discard it or modify it in the work.②Old parts should be repaired during work. | 4 In each detection, when the sensor receives a signal, it stops working to reduce the interference to other sensors. |