**Appendix B: Table and Figure of functional cells of next-generation system**

**Table** Functional cells of next-generation system

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | V | N | EO | A | T |
| 1 | transport | transfer box | conveyer belt | transport | transfer box |
| 2 | fix | transfer box | fixed structure | fix | transfer box |
| 3 | output | transfer box | conveyer belt | output | transfer box |
| 4 | detect | transfer box position | photoelectric sensor | detect | transfer box position |
| 5 | detect | workpiece quantity | weighing sensor | detect | workpiece quantity |
| 6 | detect | workpiece position | ultrasonic sensor | detect | workpiece position |
| 7 | grab | workpiece | manipulator | grab | workpiece |
| 8 | move | workpiece | move structure | move | workpiece |
| 9 | rectify | workpiece pose | correction device | rectify | workpiece pose |
| 10 | place | workpiece | correction device | place | workpiece |
| 11 | control | motor | controller | control | gear motor |
| 12 | collect | signal | controller | collect | photoelectric sensor 1signal |
| 13 | control | ultrasonic sensor | controller | control | ultrasonic sensor |
| 14 | control | weighing sensor | controller | control | weighing sensor |
| 15 | control | steering engine | controller | control | steering engine |
| 16 | control | stepper motor1-4 | controller | control | stepper motor1-4 |
| 17 | control | photoelectric sensor2-7 | controller | control | photoelectric sensor2-7 |
| 18 | control | correction device | controller | control | correction device |
| 19 | fix | gear motor | conveyer belt | fix | gear motor |
| 20 | drive | manipulator | steering engine | drive | manipulator |
| 21 | fix | manipulator | support | fix | manipulator |
| 22 | brace | support | ground | brace | support |
| 23 | brace | controller | support | brace | controller |
| 24 | fix | power supply | support | fix | power supply |
| 25 | fix | ultrasonic sensor | support | fix | ultrasonic sensor |
| 26 | fix | linear guideway | support | fix | linear guideway |
| 27 | fix | photoelectric sensor | support | fix | photoelectric sensor |
| 28 | provide | controller | power supply | provide | controller |
| 29 | provide | ultrasonic sensor | power supply | provide | ultrasonic sensor |
| 30 | provide | steering engine | power supply | provide | steering engine |
| 31 | brace | conveyer belt | ground | brace | conveyer belt |
| 32 | fix | conveyer belt | support | fix | conveyer belt |
| 33 | hold | workpiece | transfer box | hold | workpiece |
| 34 | drive | conveyer belt | gear motor | drive | conveyer belt |
| 35 | detect | linear guideway | photoelectric sensor2-7 | detect | linear guideway |
| 36 | drive | linear guideway | stepper motor | drive | linear guideway |
| 37 | fix | photoelectric sensor2-7 | linear guideway | fix | photoelectric sensor2-7 |
| 38 | provide | linear guideway | power supply | provide | linear guideway |
| 39 | fix | correction device | support | fix | correction device |



**Figure** Graphical expression of functional cells of next-generation system