

● Papers' label and the representative terms

Index	Labels	Label compositions			Representative terms
1	$Tc_{172}A_{54}$	s_{11}	ca_{12}	-	s_{11} : visual sensor + touch sensor + optical detector + arc weaving sensor; ca_{12} : linear interpolation algorithm +TP language; A_{54} : arc welding
2	$Tc_{181}A_{55}$	-	ca_2	-	ca_2 : kinematic; A_{55} : underwater work
3	$Tc_{237}A_{54}$	s_{11}	ca_{120}	-	s_{11} : visual sensor + touch sensor + optical detector + arc weaving sensor; ca_{120} : distance estimation; A_{54} : arc welding
4	$Tc_{236}A_{54}$	-	ca_8	-	ca_8 : tractive thrust; A_{54} : arc welding
5	$Tc_{171}A_{54}$	-	ca_{13}	-	ca_{13} : NDT-method; A_{54} : arc welding
6	Tm_9A_{11}	a_4	bd_{15}	bc_2	a_4 : electro + hydraulic; bd_{15} : wheel mobile lifting single arm; bc_2 : automatic; A_{11} : wall construction
7	$Tm_{25}A_{54}$	-	bd_{67}	bc_2	bd_{67} : frame system; bc_2 : automatic; A_{54} : arc welding
8	$Tc_{43}A_{14}$	s_{125}	ca_{120}	-	s_{125} : ultra-sonic sensor + magnetic sensor + camera; ca_{120} : distance estimation; A_{14} : equipment positioning
9	$Tb_{14}A_{54}$	-	bm_{14}	-	bm_{14} : cost + productivity + efficiency; A_{54} : arc welding
10	$Tm_{157}A_{50}$	-	bd_{52}	bc_3	bd_{52} : mobile vehicle; bc_3 : human-robot + collaboration; A_{50} : operation simulation
11	$Tm_{35}A_{21}$	a_2	bd_2	bc_2	a_2 : hydraulic; bd_2 : arm, manipulator + mounted; bc_2 : automatic; A_{21} : pipe construction
12	$Tm_{141}A_7$	a_4	bd_{12}	bc_2	a_4 : electro + hydraulic; bd_{12} : fixed arm; bc_2 : automatic; A_7 : excavation
13	$Tc_{97}A_{31}$	-	ca_{42}	-	ca_{42} : HyperCard program; A_{31} : slab finishing
14	Tc_7A_1	s_{65}	ca_{63}	-	s_{65} : camera + tactile; ca_{63} : Actuator-level languages; A_1 : road construction
15	$Tm_{35}A_7$	a_2	bd_2	bc_2	a_2 : hydraulic; bd_2 : arm, manipulator + mounted; bc_2 : automatic; A_7 : excavation
16	$Tc_{19}A_{50}$	s_{33}	ca_{36}	-	s_{33} : force sensor + ultrasonic sensor; ca_{36} : PID position control; A_{50} : operation simulation
17	$Tc_{11}A_{20}$	s_{34}	ca_{36}	-	s_{34} : force sensor + sonar sensor; ca_{36} : PID position control; A_{20} : spraying
18	$Tc_{97}A_{31}$	-	ca_{42}	-	ca_{42} : HyperCard program; ca_{42} : HyperCard program; A_{31} : slab finishing
19	$Tc_{115}A_4$	s_{76}	ca_{95}	-	s_{76} : distance sensor; ca_{95} : PLC; ca_{95} : PLC; A_4 : ferromagnetic surface construction
20	$Tm_{62}A_7$	a_2	bd_2	bc_1	a_2 : hydraulic; bd_2 : arm, manipulator + mounted; bc_1 : remote + operator; A_7 : excavation
21	$Tm_{156}A_6$	a_3	bd_{12}	bc_1	a_3 : motor; bd_{12} : fixed arm; bc_1 : remote + operator; A_6 : building inspection
22	$Tm_{123}A_{31}$	a_2	bd_{52}	bc_2	a_2 : hydraulic; bd_{52} : mobile vehicle; bc_2 : automatic; A_{31} : slab finishing
23	$Tm_{61}A_{29}$	a_5	bd_{27}	bc_2	a_5 : pneumatic + motor; bd_{27} : AGV, unmanned ground vehicle; bc_2 : automatic; A_{29} : material, sorting, delivery, distribution

24	$Tm_{157}A_{47}$	-	hd_{52}	hc_3	hd_{52} : mobile vehicle; hc_3 : human-robot + collaboration; A_{47} : mining
25	$Tm_{36}A_7$	a_3	bd_{12}	hc_2	a_3 : motor; bd_{12} : fixed arm; hc_2 : automatic; A_7 : excavation
26	$Tc_{82}A_{24}$	-	ca_{33}	-	ca_{33} : Brooks' algorithm; A_{24} : machinery path management
27	$Tc_{64}A_{20}$	s_6	ca_{38}	-	s_6 : torque/force sensor + force sensor; ca_{38} : least squares algorithm; A_{20} : spraying
28	$Tc_{97}A_7$	-	ca_{42}	-	ca_{42} : HyperCard program; A_7 : excavation
29	$Tc_{106}A_{32}$	s_{39}	ca_{52}	-	s_{39} : camera + image + CCD + Kinect; ca_{52} : longest common subsequence (LCS); A_{32} : machinery navigation
30	$Tc_{80}A_{24}$	s_{10}	ca_{65}	-	s_{10} : ultrasonic; ca_{65} : path-planning; A_{24} : machinery path management
31	$Tm_{33}A_{20}$	a_3	bd_{21}	hc_2	a_3 : motor; bd_{21} : mobile arm; hc_2 : automatic; A_{20} : spraying
32	$Tm_{39}A_{22}$	a_3	bd_{55}	hc_2	a_3 : motor; bd_{55} : vertically mobile arm; hc_2 : automatic; A_{22} : masonry construction
33	$Tm_{142}A_7$	a_4	bd_{12}	hc_2	a_4 : electro + hydraulic; bd_{12} : fixed arm; hc_2 : automatic; A_7 : excavation
34	$Tm_{126}A_6$	a_5	bd_2	hc_2	a_5 : pneumatic + motor; bd_2 : arm, manipulator + mounted; hc_2 : automatic; A_6 : building inspection
35	$Tm_{36}A_{21}$	a_3	bd_{12}	hc_2	a_3 : motor; bd_{12} : fixed arm; hc_2 : automatic; A_{21} : pipe construction
36	$Tc_{13}A_{14}$	-	ca_{115}	-	ca_{115} : self-positioning algorithm; A_{14} : equipment positioning
37	$Tc_{97}A_{48}$	-	ca_{42}	-	ca_{42} : HyperCard program; A_{48} : logistics
38	$Tc_{87}A_{50}$	-	ca_5	-	ca_5 : PI controller + active control algorithm; A_{50} : operation simulation
39	$Tc_{75}A_{22}$	s_{74}	ca_{73}	-	s_{74} : ultrasonic sensor + displacement transducers + ranging transducer + laser scanner; ca_{73} : Machine Learning; A_{22} : masonry construction
40	$Tc_{137}A_{45}$	s_{50}	ca_{79}	-	s_{50} : position sensor + force sensor; ca_{79} : RBF-PID Control; A_{45} : cleaning
41	$Tm_{151}A_{21}$	-	bd_{52}	hc_1	bd_{52} : mobile vehicle; hc_1 : remote + operator; A_{21} : pipe construction
42	$Tm_{40}A_{22}$	a_2	bd_{56}	hc_2	a_2 : hydraulic; bd_{56} : rail moving arm; hc_2 : automatic; A_{22} : masonry construction
43	$Tm_{40}A_{22}$	a_2	bd_{56}	hc_2	a_2 : hydraulic; bd_{56} : rail moving arm; hc_2 : automatic; A_{22} : masonry construction
44	$Tm_{19}A_{22}$	a_2	bd_2	hc_2	a_2 : hydraulic; bd_2 : arm, manipulator + mounted; hc_2 : automatic; A_{22} : masonry construction
45	$Tm_{98}A_6$	a_3	bd_{19}	hc_2	a_3 : motor; bd_{19} : climbing platforms + vacuum grippers + suction; hc_2 : automatic; A_6 : building inspection
46	$Tm_{13}A_{29}$	a_3	bd_7	hc_2	a_3 : motor; bd_7 : gantry robot, arm; hc_2 : automatic; A_{29} : material, sorting, delivery, distribution
47	$Tm_{60}A_{34}$	a_3	bd_{12}	hc_2	a_3 : motor; bd_{12} : fixed arm; hc_2 : automatic; A_{34} : components assemble
48	$Tm_{22}A_{58}$	a_3	bd_{32}	hc_2	a_3 : motor; bd_{32} : wheel mobile; hc_2 : automatic; A_{58} : finishing
49	$Tm_{25}A_{53}$	-	bd_{67}	hc_2	bd_{67} : frame system; hc_2 : automatic; A_{53} : highway construction

50	$Tm_{23}A_{24}$	-	hd_{32}	hc_2	hd_{32} : wheel mobile; hc_2 : automatic; A_{24} : machinery path management
51	$Tc_{51}A_{50}$	s_{22}	ca_{10}	-	s_{22} : position sensor; ca_{10} : heuristic; A_{50} : operation simulation
52	$Tc_{84}A_{24}$	-	ca_{103}	-	ca_{103} : motion planning; A_{24} : machinery path management
53	Tb_2A_{53}	-	bm_2	-	bm_2 : technical + economic + efficiency; A_{53} : highway construction
54	$Tm_{124}A_{59}$	a_2	hd_{12}	hc_2	a_2 : hydraulic; hd_{12} : fixed arm; hc_2 : automatic; A_{59} : object recognition
55	$Tm_{10}A_{11}$	a_3	hd_{16}	hc_2	a_3 : motor; hd_{16} : climbing platform + pediculate + gripper; hc_2 : automatic; A_{11} : wall construction
56	$Tm_{34}A_{20}$	a_3	hd_{32}	hc_2	a_3 : motor; hd_{32} : wheel mobile; hc_2 : automatic; A_{20} : spraying
57	$Tm_{49}A_{34}$	-	hd_{36}	hc_2	hd_{36} : mobile arm, manipulator with wheels; hc_2 : automatic; A_{34} : components assemble
58	$Tm_{25}A_{54}$	-	hd_{67}	hc_2	hd_{67} : frame system; hc_2 : automatic; A_{54} : arc welding
59	$Tm_{25}A_{54}$	-	hd_{67}	hc_2	hd_{67} : frame system; hc_2 : automatic; A_{54} : arc welding
60	$Tm_{28}A_{11}$	-	-	hc_2	hc_2 : automatic; A_{11} : wall construction
61	$Tm_{88}A_{44}$	a_3	hd_2	hc_2	a_3 : motor; hd_2 : arm, manipulator + mounted; hc_2 : automatic; A_{44} : panel installation
62	$Tc_{84}A_{34}$	-	ca_{103}	-	ca_{103} : motion planning; A_{34} : components assemble
63	$Tc_{164}A_{50}$	-	ca_{114}	-	ca_{114} : behaviour-based system; A_{50} : operation simulation
64	$Tc_{13}A_{14}$	-	ca_{115}	-	ca_{115} : self-positioning algorithm; A_{14} : equipment positioning
65	$Tc_{79}A_{22}$	s_{21}	ca_{70}	-	s_{21} : distance sensor + tilt sensor; ca_{70} : PTP control; A_{22} : masonry construction
66	$Tc_{116}A_{58}$	-	ca_{70}	-	ca_{70} : PTP control; A_{58} : finishing
67	$Tc_{78}A_{22}$	s_1	ca_{71}	-	s_1 : laser + ultrasonic + CCD camera; ca_{71} : TCP control; A_{22} : masonry construction
68	$Tc_{27}A_{11}$	-	ca_{90}	-	ca_{90} : C++, Java, C# script, C program; A_{11} : wall construction
69	Tm_1A_1	a_2	hd_{32}	hc_2	a_2 : hydraulic; hd_{32} : wheel mobile; hc_2 : automatic; A_1 : road construction
70	$Tm_{59}A_{28}$	a_3	hd_{15}	hc_2	a_3 : motor; hd_{15} : wheel mobile lifting single arm; hc_2 : automatic; A_{28} : ceiling construction
71	$Tm_{127}A_6$	a_3	hd_{36}	hc_2	a_3 : motor; hd_{36} : mobile arm, manipulator with wheels; hc_2 : automatic; A_6 : building inspection
72	$Tm_{41}A_{22}$	a_5	hd_{12}	hc_2	a_5 : pneumatic + motor; hd_{12} : fixed arm; hc_2 : automatic; A_{22} : masonry construction
73	$Tm_{25}A_{54}$	-	hd_{67}	hc_2	hd_{67} : frame system; hc_2 : automatic; A_{54} : arc welding
74	$Tm_{28}A_{17}$	-	-	hc_2	hc_2 : automatic; A_{17} : high rise building construction
75	$Tm_{64}A_{50}$	-	hd_{30}	hc_3	hd_{30} : industrial robot; hc_3 : human-robot + collaboration; A_{50} : operation simulation

76	$Tc_{140}A_{46}$	s_1	ca_{120}	-	s_1 : laser + ultrasonic + CCD camera; ca_{120} : distance estimation; A_{46} : machinery mapping
77	$Tc_{170}A_{54}$	s_{14}	ca_{14}	-	s_{14} : laser; ca_{14} : control travel speed; A_{54} : arc welding
78	$Tc_{117}A_{34}$	s_{70}	ca_{26}	-	ca_{26} : fusion fuzzy, fuzzy logic, fuzzy set theory; A_{34} : components assemble
79	$Tc_{189}A_{32}$	-	ca_{26}	-	ca_{26} : fusion fuzzy, fuzzy logic, fuzzy set theory; A_{32} : machinery navigation
80	$Tc_{189}A_{56}$	-	ca_{26}	-	ca_{26} : fusion fuzzy, fuzzy logic, fuzzy set theory
81	$Tc_{60}A_{53}$	s_{14}	ca_{46}	-	s_{14} : laser; ca_{46} : embedded, embedding, controller; A_{53} : highway construction
82	$Tc_{33}A_{12}$	-	ca_{49}	-	ca_{49} : genetic algorithms (GA); A_{12} : bridge construction
83	$Tc_{121}A_{26}$	s_{154}	ca_{90}	-	s_{154} : equivalent sensor; ca_{90} : C++, Java, C# script, C program; A_{26} : remote operating machines
84	$Tc_{42}A_{53}$	s_{54}	ca_{90}	-	s_{54} : laser + cameras + Kinect; ca_{90} : C++, Java, C# script, C program; A_{53} : highway construction
85	$Tc_{205}A_{50}$	-	ca_{92}	-	ca_{92} : Virtual Reality; A_{50} : operation simulation
86	$Tc_{29}A_{12}$	s_{39}	ca_{96}	-	s_{39} : camera + image + CCD + Kinect; ca_{96} : real time navigation; A_{12} : bridge construction
87	$Tm_{11}A_{11}$	a_3	hd_{17}	hc_2	a_3 : motor; hd_{17} : lift fixed manipulator; hc_2 : automatic; A_{11} : wall construction
88	Tm_8A_8	a_3	hd_2	hc_3	a_3 : motor; hd_2 : arm, manipulator + mounted; hc_3 : human-robot + collaboration; A_8 : steel construction
89	Tc_6A_1	s_{66}	ca_{64}	-	s_{66} : GPS, position sensor, reference sensor; ca_{64} : iterative algorithms + regression model; A_1 : road construction
90	Tc_5A_1	s_{67}	ca_{65}	-	s_{67} : GPS; ca_{65} : path-planning; A_1 : road construction
91	Tc_4A_1	s_6	ca_{73}	-	s_6 : torque/force sensor + force sensor; ca_{73} : Machine Learning; A_1 : road construction
92	$Tc_{31}A_{12}$	s_{94}	ca_{96}	-	s_{94} : LTK + GPS + pseudofiles + laser + NLS; ca_{96} : real time navigation; A_{12} : bridge construction
93	$Tm_{62}A_{29}$	a_2	hd_2	hc_1	a_2 : hydraulic; hd_2 : arm, manipulator + mounted; hc_1 : remote + operator; A_{29} : material, sorting, delivery, distribution
94	$Tm_{24}A_{17}$	a_2	hd_{67}	hc_2	a_2 : hydraulic; hd_{67} : frame system; hc_2 : automatic; A_{17} : high rise building construction
95	$Tm_{13}A_8$	a_3	hd_7	hc_2	a_3 : motor; hd_7 : gantry robot, arm; hc_2 : automatic; A_8 : steel construction
96	$Tm_{60}A_{54}$	a_3	hd_{12}	hc_2	a_3 : motor; hd_{12} : fixed arm; hc_2 : automatic; A_{54} : arc welding
97	$Tm_{106}A_{49}$	-	hd_{49}	hc_2	hd_{49} : robotized crane; hc_2 : automatic; A_{49} : transmission tower construction
98	$Tc_{200}A_{56}$	-	ca_{81}	-	ca_{81} : predictive force method; A_{56} : remote construction
99	$Tc_{70}A_{38}$	-	ca_{89}	-	ca_{89} : trajectory generation algorithm; A_{38} : marking
100	$Tc_{118}A_{34}$	s_{138}	ca_{26}	-	s_{138} : axis sensors; ca_{26} : fusion fuzzy, fuzzy logic, fuzzy set theory; A_{34} : components assemble
101	$Tc_{226}A_7$	s_{44}	ca_{43}	-	s_{44} : force sensor + pressure transducers; ca_{43} : inverse kinematic and dynamic models; A_7 : excavation

102	$T_{c57}A_2$	s_{39}	ca_{61}	-	s_{39} : camera + image + CCD + Kinect; ca_{61} : pixels regression
103	Tb_9A_{29}	-	bm_9	-	bm_9 : material management; A_{29} : material, sorting, delivery, distribution
104	$Tm_{152}A_{56}$	a_3	bd_{67}	bc_1	a_3 : motor; bd_{67} : frame system; bc_1 : remote + operator; A_{56} : remote construction
105	$Tm_{151}A_{56}$	-	bd_{52}	bc_1	bd_{52} : mobile vehicle; bc_1 : remote + operator; A_{56} : remote construction
106	$Tm_{12}A_{11}$	a_2	bd_7	bc_2	a_2 : hydraulic; bd_7 : gantry robot, arm; bc_2 : automatic; A_{11} : wall construction
107	$Tm_{19}A_{12}$	a_2	bd_2	bc_2	a_2 : hydraulic; bd_2 : arm, manipulator + mounted; bc_2 : automatic; A_{12} : bridge construction
108	$Tm_{96}A_{45}$	a_3	bd_{34}	bc_2	a_3 : motor; bd_{34} : vertical mobile + cleaning head + pressure pump + suction device + filter + tank; bc_2 : automatic; A_{45} : cleaning
109	$Tc_{169}A_{12}$	-	ca_{15}	-	ca_{15} : off-line teaching system; A_{12} : bridge construction
110	$Tm_{112}A_{54}$	-	bd_{11}	bc_2	bd_{11} : lifting rail + moved arm + carriage; bc_2 : automatic; A_{54} : arc welding
111	$Tm_{32}A_{20}$	a_2	bd_{12}	bc_3	bd_{12} : fixed arm; A_{20} : spraying
112	$Tc_{54}A_{19}$	s_{118}	ca_{115}	-	s_{118} : camera + sonar sensor + temperature sensor + airflow sensors + laser; ca_{115} : self-positioning algorithm; A_{19} : building maintenance
113	$Tc_{41}A_{14}$	s_{39}	ca_{56}	-	s_{39} : camera + image + CCD + Kinect; A_{14} : equipment positioning
114	$Tc_{224}A_7$	s_{45}	ca_{89}	-	s_{45} : force and position sensors + ground penetrating radar (GPR) + laser; ca_{89} : trajectory generation algorithm; A_7 : excavation
115	$Tm_{85}A_{42}$	a_2	bd_3	bc_1	a_2 : hydraulic; bd_3 : crawler; bc_1 : remote + operator; A_{42} : disaster restoration
116	$Tm_{128}A_6$	a_3	bd_{70}	bc_2	a_3 : motor; bd_{70} : mobility feet, leg, limbed; bc_2 : automatic; A_6 : building inspection
117	$Tm_{143}A_7$	a_4	bd_{33}	bc_2	a_4 : electro + hydraulic; bd_{33} : bucket + arm; bc_2 : automatic; A_7 : excavation
118	$Tc_{95}A_{30}$	s_6	ca_{100}	-	s_6 : torque/force sensor + force sensor; ca_{100} : markov chains; A_{30} : Mars/Lunar construction
119	$Tc_{124}A_{38}$	s_{14}	ca_{115}	-	s_{14} : laser; ca_{115} : self-positioning algorithm; A_{38} : marking
120	$Tc_{87}A_{26}$	s_8	ca_5	-	s_8 : pressure sensor; ca_5 : PI controller, active control algorithm; A_{26} : remote operating machines
121	$Tc_{144}A_5$	s_{86}	ca_{87}	-	s_{86} : range sensor + displacement sensor + GPS; ca_{87} : Bug-based algorithm
122	$Tm_{152}A_{56}$	a_3	bd_{67}	bc_1	a_3 : motor; bd_{67} : frame system; bc_1 : remote + operator; A_{56} : remote construction
123	$Tm_{150}A_{56}$	a_2	bd_1	bc_2	bd_1 : humanoid; bc_2 : automatic; A_{56} : remote construction
124	$Tm_{113}A_{54}$	a_3	bd_{10}	bc_2	a_3 : motor; bd_{10} : traveling crane; bc_2 : automatic; A_{54} : arc welding
125	$Tm_{28}A_{11}$	-	-	bc_2	bc_2 : automatic; A_{11} : wall construction
126	$Tm_{91}A_{56}$	a_1	bd_{67}	bc_3	a_1 : pneumatic; bd_{67} : frame system; bc_3 : human-robot + collaboration; A_{56} : remote construction

127	$Tm_{55}A_{28}$	a_3	bd_{36}	bc_2	a_3 : motor; bd_{36} : mobile arm, manipulator with wheels; bc_2 : automatic; A_{28} : ceiling construction
128	$Tc_{187}A_{56}$	-	ca_{31}	-	ca_{31} : wireless communication + wireless Lan; A_{56} : remote construction
129	$Tc_{187}A_{56}$	-	ca_{31}	-	ca_{31} : wireless communication + wireless Lan; A_{56} : remote construction
130	$Tc_{138}A_{45}$	s_{33}	ca_{43}	-	s_{33} : force sensor + ultrasonic sensor; ca_{43} : inverse kinematic and dynamic models
131	$Tc_{222}A_7$	s_{47}	ca_{47}	-	s_{47} : force sensors + laser + GPS + INS; ca_{47} : UML state charts and capsules; A_7 : excavation
132	$Tc_{33}A_{12}$	-	ca_{49}	-	ca_{49} : genetic algorithms (GA); A_{12} : bridge construction
133	$Tc_{182}A_{55}$	s_1	ca_{62}	-	s_1 : laser + ultrasonic + CCD camera; ca_{62} : image processing; A_{55} : underwater work
134	$Tc_{56}A_2$	s_{54}	ca_{62}	-	s_{54} : laser + cameras + Kinect; ca_{62} : image processing
135	$Tc_{76}A_{24}$	-	ca_{73}	-	ca_{73} : Machine Learning; A_{24} : machinery path management
136	$Tb_{14}A_{35}$	-	bm_{14}	-	bm_{14} : cost + productivity + efficiency; A_{35} : construction activity evaluation
137	$Tm_{117}A_{55}$	a_1	bd_2	bc_1	a_1 : pneumatic; bd_2 : arm, manipulator + mounted; bc_1 : remote + operator; A_{55} : underwater work
138	$Tm_{60}A_{28}$	a_3	bd_{12}	bc_2	a_3 : motor; bd_{12} : fixed arm; bc_2 : automatic; A_{28} : ceiling construction
139	$Tm_{26}A_8$	-	bd_{49}	bc_2	bd_{49} : robotized crane; bc_2 : automatic; A_8 : steel construction
140	$Tm_{14}A_{63}$	-	bd_7	bc_2	bd_7 : gantry robot, arm; bc_2 : automatic; A_{63} : contour crafting
141	$Tm_{28}A_{11}$	-	-	bc_2	bc_2 : automatic; A_{11} : wall construction
142	$Tc_{216}A_6$	s_{54}	ca_{102}	-	s_{54} : laser + cameras + Kinect; ca_{102} : MPEG algorithm + pair-wise alignment algorithm + Minimum V variance Matching (MVM) Algorithm
143	$Tc_{26}A_{11}$	s_{22}	ca_{25}	-	s_{22} : position sensor; ca_{25} : search algorithm; A_{11} : wall construction
144	$Tc_{23}A_{11}$	s_{23}	ca_{26}	-	s_{23} : rotation angles sensors + vacuum sensors + accelerometers + pressure sensor; ca_{26} : fusion fuzzy, fuzzy logic, fuzzy set theory; A_{11} : wall construction
145	$Tc_{93}A_3$	s_{39}	ca_{36}	-	s_{39} : camera + image + CCD + Kinect; ca_{36} : PID position control; ca_{36} : PID position control; A_3 : building service
146	Tc_3A_1	s_{54}	ca_{67}	-	s_{54} : laser + cameras + Kinect; ca_{67} : Kalman Filter Algorithm; A_1 : road construction
147	$Tm_{107}A_{56}$	-	-	bc_1	bc_1 : remote + operator; A_{56} : remote construction
148	$Tm_{65}A_{60}$	a_1	bd_{70}	bc_2	a_1 : pneumatic; bd_{70} : mobility feet, leg, limbed; bc_2 : automatic; A_{60} : drilling
149	$Tm_{129}A_6$	a_3	bd_{74}	bc_2	a_3 : motor; bd_{74} : worm-like, snake-like robot; bc_2 : automatic; A_6 : building inspection
150	$Tm_{130}A_6$	a_3	bd_{70}	bc_2	a_3 : motor; bd_{70} : mobility feet, leg, limbed; bc_2 : automatic; A_6 : building inspection
151	$Tm_{28}A_{11}$	-	-	bc_2	bc_2 : automatic; A_{11} : wall construction

152	$Tm_{81}A_{40}$	a_2	hd_{49}	hc_3	a_2 : hydraulic; hd_{49} : robotized crane; hc_3 : human-robot + collaboration; A_{40} : harbour construction
153	Tm_7A_{11}	a_5	hd_{20}	hc_3	a_5 : pneumatic + motor; hd_{20} : climbing two platforms + light skeleton + vacuum grippers; hc_3 : human-robot + collaboration; A_{11} : wall construction
154	$Tc_{132}A_{42}$	s_{14}	ca_{109}	-	s_{14} : laser; ca_{109} : stereovision method; A_{42} : disaster restoration
155	$Tc_{232}A_{51}$	s_{87}	ca_{109}	-	s_{87} : range sensors + distance sensor; ca_{109} : stereovision method; A_{51} : pose estimation
156	$Tc_{55}A_{19}$	s_{38}	ca_{114}	-	s_{38} : cameras + pressure force sensor; ca_{114} : behaviour-based system; A_{19} : building maintenance
157	$Tc_{22}A_{11}$	s_{24}	ca_{27}	-	s_{24} : light sensor + infrared proximity sensors; ca_{27} : distributed feedback mechanism; A_{11} : wall construction
158	$Tc_{105}A_{32}$	s_{142}	ca_{31}	-	s_{142} : light sensors + humidity/temperature sensors + sonar sensors + ultrasonic range sensor + infrared distance measuring sensors + CMOS image sensor; ca_{31} : wireless communication + wireless Lan; A_{32} : machinery navigation
159	$Tc_{154}A_{50}$	-	ca_{46}	-	ca_{46} : embedded, embedding, controller; A_{50} : operation simulation
160	$Tc_{145}A_5$	s_{87}	ca_{65}	-	s_{87} : range sensors + distance sensor; ca_{65} : path-planning; A_5 : earthmoving construction
161	Tc_2A_1	s_{68}	ca_{68}	-	s_{68} : GPS + inclinometer; ca_{68} : Msc. Adams and Matlab/Simulink programs; A_1 : road construction
162	Tc_1A_1	s_{69}	ca_{69}	-	s_{69} : GPS + laser; ca_{69} : dynamic model; A_1 : road construction
163	$Tc_{197}A_{50}$	s_{81}	ca_{79}	-	s_{81} : angle sensor; ca_{79} : RBF-PID Control; A_{50} : operation simulation
164	$Tc_{27}A_8$	s_{39}	ca_{90}	-	s_{39} : camera + image + CCD + Kinect; ca_{90} : C++, Java, C# script, C program; A_8 : steel construction
165	$Tm_{84}A_{41}$	a_1	hd_{30}	hc_1	a_1 : pneumatic; hd_{30} : industrial robot; hc_1 : remote + operator; A_{41} : waste collection
166	$Tm_{118}A_{55}$	a_2	hd_3	hc_1	a_2 : hydraulic; hd_3 : crawler; hc_1 : remote + operator; A_{55} : underwater work
167	$Tm_{94}A_{56}$	a_2	-	hc_1	a_2 : hydraulic; hc_1 : remote + operator; A_{56} : remote construction
168	$Tm_{18}A_{11}$	a_3	hd_{32}	hc_1	a_3 : motor; hd_{32} : wheel mobile; hc_1 : remote + operator; A_{11} : wall construction
169	$Tm_{86}A_{42}$	-	hd_3	hc_1	hd_3 : crawler; hc_1 : remote + operator; A_{42} : disaster restoration
170	$Tm_{53}A_{23}$	a_3	hd_{66}	hc_2	a_3 : motor; hd_{66} : mobile tracked locomotion; hc_2 : automatic; A_{23} : on-site rescue
171	$Tm_{51}A_{59}$	-	hd_{30}	hc_2	hd_{30} : industrial robot; hc_2 : automatic; A_{59} : object recognition
172	$Tm_{25}A_{34}$	-	hd_{67}	hc_2	hd_{67} : frame system; hc_2 : automatic; A_{34} : components assemble
173	Tm_8A_{11}	a_3	hd_2	hc_3	a_3 : motor; hd_2 : arm, manipulator + mounted; hc_3 : human-robot + collaboration; A_{11} : wall construction
174	$Tm_{89}A_{44}$	-	-	hc_3	hc_3 : human-robot + collaboration; A_{44} : panel installation
175	$Tc_{215}A_6$	s_{39}	ca_{103}	-	s_{39} : camera + image + CCD + Kinect; ca_{103} : motion planning; A_6 : building inspection
176	$Tc_{93}A_{56}$	s_{39}	ca_{36}	-	s_{39} : camera + image + CCD + Kinect; ca_{36} : PID position control; A_{56} : remote construction

177	$Tc_{33}A_{50}$	-	ca_{49}	-	ca_{49} : genetic algorithms (GA); A_{50} : operation simulation
178	$Tc_{76}A_{52}$	-	ca_{73}	-	ca_{73} : Machine Learning; ca_{73} : Machine Learning; A_{52} : measurement
179	$Tc_{199}A_{56}$	s_{39}	ca_{80}	-	s_{39} : camera + image + CCD + Kinect; ca_{80} : augmented reality techniques (AR); A_{56} : remote construction
180	$Tc_{229}A_8$	-	ca_{91}	-	ca_{91} : pre-acting control algorithm; A_8 : steel construction
181	Tb_6A_{12}	-	bm_6	-	bm_6 : cost + quality; A_{12} : bridge construction
182	$Tm_{38}A_{21}$	a_2	hd_{69}	bc_1	a_2 : hydraulic; hd_{69} : platform clamp; bc_1 : remote + operator; A_{21} : pipe construction
183	$Tm_{93}A_{44}$	-	hd_2	bc_1	hd_2 : arm, manipulator + mounted; bc_1 : remote + operator; A_{44} : panel installation
184	Tm_1A_1	a_2	hd_{32}	bc_2	a_2 : hydraulic; hd_{32} : wheel mobile; bc_2 : automatic; A_1 : road construction
185	$Tm_{80}A_6$	a_3	hd_{58}	bc_2	a_3 : motor; hd_{58} : UAV; bc_2 : automatic; A_6 : building inspection
186	$Tm_{16}A_{63}$	a_6	hd_{25}	bc_2	a_6 : cable driven; hd_{25} : parallel robot; bc_2 : automatic; A_{63} : contour crafting
187	$Tm_{146}A_8$	-	hd_{26}	bc_2	hd_{26} : rail, vertical-moving robot; bc_2 : automatic; A_8 : steel construction
188	$Tm_{25}A_{63}$	-	hd_{67}	bc_2	hd_{67} : frame system; bc_2 : automatic; A_{63} : contour crafting
189	$Tm_{56}A_{28}$	a_3	hd_{42}	bc_3	a_3 : motor; hd_{42} : mobile vehicle + aerial lift + manipulator + vacuum suction device; bc_3 : human-robot + collaboration; A_{28} : ceiling construction
190	$Tm_{63}A_6$	a_3	hd_{32}	bc_3	a_3 : motor; hd_{32} : wheel mobile; bc_3 : human-robot + collaboration; A_6 : building inspection
191	Tm_8A_{11}	a_3	hd_2	bc_3	a_3 : motor; hd_2 : arm, manipulator + mounted; bc_3 : human-robot + collaboration; A_{11} : wall construction
192	Tm_8A_{44}	a_3	hd_2	bc_3	a_3 : motor; hd_2 : arm, manipulator + mounted; bc_3 : human-robot + collaboration; A_{44} : panel installation
193	$Tm_{70}A_{34}$	-	hd_{60}	bc_3	hd_{60} : truss-type; bc_3 : human-robot + collaboration; A_{34} : components assemble
194	$Tm_{90}A_{44}$	-	hd_{67}	bc_3	hd_{67} : frame system; bc_3 : human-robot + collaboration; A_{44} : panel installation
195	$Tc_{168}A_{54}$	-	ca_{16}	-	ca_{16} : user datagram protocol (UDP); A_{54} : arc welding
196	$Tc_{89}A_{29}$	s_{114}	ca_{36}	-	s_{114} : ultrasonic sensors + encoders + IMU + yaw angle sensor + sonar sensors; ca_{36} : PID position control; A_{29} : material, sorting, delivery, distribution
197	$Tc_{119}A_{34}$	s_{39}	ca_{79}	-	s_{39} : camera + image + CCD + Kinect; ca_{79} : RBF-PID Control; A_{34} : components assemble
198	$Tc_{198}A_{56}$	s_6	ca_{79}	-	s_6 : torque/force sensor + force sensor; ca_{79} : RBF-PID Control; A_{56} : remote construction
199	$Tc_{86}A_{56}$	-	ca_{86}	-	ca_{86} : master-slave system; A_{56} : remote construction
200	$Tc_{149}A_{50}$	s_{89}	ca_{90}	-	s_{89} : liquid based sensor; ca_{90} : C++, Java, C# script, C program; A_{50} : operation simulation
201	Tb_9A_{29}	-	bm_9	-	bm_9 : material management; A_{29} : material, sorting, delivery, distribution

202	$Tm_{122}A_{56}$	a_1	bd_{12}	bc_1	a_1 : pneumatic; bd_{12} : fixed arm; bc_1 : remote + operator; A_{56} : remote construction
203	$Tm_{95}A_{44}$	a_3	bd_{32}	bc_1	a_3 : motor; bd_{32} : wheel mobile; bc_1 : remote + operator; A_{44} : panel installation
204	Tm_2A_1	a_3	bd_{52}	bc_2	a_3 : motor; bd_{52} : mobile vehicle; bc_2 : automatic; A_1 : road construction
205	$Tm_{13}A_8$	a_3	bd_7	bc_2	a_3 : motor; bd_7 : gantry robot, arm; bc_2 : automatic; A_8 : steel construction
206	$Tm_{37}A_{21}$	a_2	bd_{25}	bc_3	bd_{25} : parallel robot; bc_3 : human-robot + collaboration; A_{21} : pipe construction
207	$Tm_{57}A_{28}$	a_3	bd_{44}	bc_3	a_3 : motor; bd_{44} : manipulator + vacuum suction + wheel mobility; bc_3 : human-robot + collaboration
208	$Tm_{139}A_{60}$	a_3	bd_{12}	bc_3	a_3 : motor; bd_{12} : fixed arm; bc_3 : human-robot + collaboration; A_{60} : drilling
209	$Tm_{71}A_{34}$	-	bd_{45}	bc_3	bd_{45} : wearable; bc_3 : human-robot + collaboration; A_{34} : components assemble
210	$Tm_{89}A_{10}$	-	-	bc_3	bc_3 : human-robot + collaboration; A_{10} : glass installation
211	$Tm_{144}A_8$	a_2	bd_{63}	bc_3	a_2 : hydraulic; bd_{63} : scissor-jack manipulator; bc_3 : human-robot + collaboration; A_8 : steel construction
212	$Tc_{71}A_{22}$	s_{18}	ca_{105}	-	s_{18} : various sensors + sensor system; ca_{105} : A* algorithm, A-star; A_{22} : masonry construction
213	$Tc_{91}A_{29}$	s_{113}	ca_{111}	-	s_{113} : rotation angle + encoder sensor + laser, accelerometer; ca_{111} : measures vector value of vertical lifting; A_{29} : material, sorting, delivery, distribution
214	$Tc_{192}A_{56}$	s_{134}	ca_{113}	-	s_{134} : magnetic stroke sensors + pressure sensors + stereo camera; ca_{113} : velocity control; A_{56} : remote construction
215	$Tc_{104}A_{32}$	s_{14}	ca_{25}	-	s_{14} : laser; ca_{25} : search algorithm; A_{32} : machinery navigation
216	$Tc_{167}A_{54}$	s_{14}	ca_{32}	-	s_{14} : laser; ca_{32} : parametric-integrated algorithm, parametric synthesis; A_{54} : arc welding
217	$Tc_{186}A_{56}$	s_{133}	ca_{36}	-	s_{133} : stereo camera + acceleration sensor; ca_{36} : PID position control; A_{56} : remote construction
218	$Tc_{128}A_{41}$	s_{81}	ca_{59}	-	s_{81} : angle sensor; ca_{59} : primitive static states; A_{41} : waste collection
219	$Tc_{209}A_6$	s_{104}	ca_{73}	-	s_{104} : gyro sensor + laser sensor + CCD camera; ca_{73} : Machine Learning; A_6 : building inspection
220	$Tb_{10}A_{14}$	-	bm_{10}	-	bm_{10} : position + internal + error + force; A_{14} : equipment positioning
221	$Tb_{12}A_{35}$	-	bm_{12}	-	bm_{12} : sustainability + performance + environment; A_{35} : construction activity evaluation
222	Tb_7A_{21}	-	bm_7	-	bm_7 : productivity + economic + sensitivity + safety + quality; A_{21} : pipe construction
223	Tm_3A_1	a_1	bd_2	bc_2	a_1 : pneumatic; bd_2 : arm, manipulator + mounted; bc_2 : automatic; A_1 : road construction
224	$Tm_{129}A_6$	a_3	bd_{74}	bc_2	a_3 : motor; bd_{74} : worm-like, snake-like robot; bc_2 : automatic; A_6 : building inspection
225	$Tm_{13}A_8$	a_3	bd_7	bc_2	a_3 : motor; bd_7 : gantry robot, arm; bc_2 : automatic; A_8 : steel construction
226	$Tm_{26}A_{29}$	-	bd_{49}	bc_2	bd_{49} : robotized crane; bc_2 : automatic; A_{29} : material, sorting, delivery, distribution
227	$Tm_{145}A_8$	a_3	bd_{63}	bc_3	a_3 : motor; bd_{63} : scissor-jack manipulator; bc_3 : human-robot + collaboration; A_8 : steel construction

228	$Tc_{190}A_{56}$	s_{135}	ca_{26}	-	s_{135} : force sensor + tracker sensor + stereo camera; ca_{26} : fusion fuzzy, fuzzy logic, fuzzy set theory; A_{56} : remote construction
229	$Tc_{160}A_{50}$	-	ca_{45}	-	ca_{45} : discrete event simulation model; A_{50} : operation simulation
230	$Tc_{162}A_{50}$	s_{57}	ca_{79}	-	s_{57} : environmental sensor; ca_{79} : RBF-PID Control; A_{50} : operation simulation
231	$Tc_{198}A_{56}$	s_6	ca_{79}	-	s_6 : torque/force sensor + force sensor; ca_{79} : RBF-PID Control; A_{56} : remote construction
232	$Tc_{199}A_{56}$	s_{39}	ca_{80}	-	s_{39} : camera + image + CCD + Kinect; ca_{80} : augmented reality techniques (AR); A_{56} : remote construction
233	$Tc_{196}A_{50}$	s_6	ca_{84}	-	s_6 : torque/force sensor + force sensor; ca_{84} : Force feedback control; A_{50} : operation simulation
234	$Tc_{201}A_{50}$	s_6	ca_{86}	-	s_6 : torque/force sensor + force sensor; ca_{86} : master-slave system; A_{50} : operation simulation
235	$Tc_{86}A_{56}$	-	ca_{86}	-	ca_{86} : master-slave system; A_{56} : remote construction
236	$Tm_{92}A_{44}$	a_2	hd_{24}	hc_2	a_2 : hydraulic; hd_{24} : climbing system; hc_2 : automatic; A_{44} : panel installation
237	$Tm_{50}A_{45}$	a_3	hd_{36}	hc_2	a_3 : motor; hd_{36} : mobile arm, manipulator with wheels; hc_2 : automatic; A_{45} : cleaning
238	$Tm_{66}A_{10}$	a_3	hd_{25}	hc_2	a_3 : motor; hd_{25} : parallel robot; hc_2 : automatic; A_{10} : glass installation
239	$Tm_{14}A_8$	-	hd_7	hc_2	hd_7 : gantry robot, arm; hc_2 : automatic; A_8 : steel construction
240	$Tm_{54}A_{26}$	a_2	hd_{61}	hc_3	a_2 : hydraulic; hd_{61} : excavator arm + double front ; hc_3 : human-robot + collaboration; A_{26} : remote operating machines
241	Tm_8A_{44}	a_3	hd_2	hc_3	a_3 : motor; hd_2 : arm, manipulator + mounted; hc_3 : human-robot + collaboration; A_{44} : panel installation
242	$Tc_{214}A_6$	-	ca_{104}	-	ca_{104} : integral monitoring system; A_6 : building inspection
243	$Tc_{211}A_6$	s_{109}	ca_{107}	-	s_{109} : GPS + camera; ca_{107} : random walk algorithm; A_6 : building inspection
244	$Tc_{49}A_{17}$	s_{157}	ca_{112}	-	s_{157} : Zigbee sensors + laser finder; ca_{112} : Ubiquitous Sensor Network; A_{17} : high rise building construction
245	$Tc_{164}A_{50}$	-	ca_{114}	-	ca_{114} : behaviour-based system; A_{50} : operation simulation
246	$Tc_{20}A_{11}$	-	ca_{28}	-	ca_{28} : motion simulation; A_{11} : wall construction
247	$Tc_{24}A_{40}$	s_8	ca_{38}	-	s_8 : pressure sensor; ca_{38} : least squares algorithm; A_{40} : harbour construction
248	$Tc_{155}A_{52}$	s_{108}	ca_{62}	-	s_{108} : camera + LED + light; ca_{62} : image processing; A_{52} : measurement
249	$Tc_{94}A_{30}$	s_{109}	ca_{62}	-	s_{109} : GPS + camera; ca_{62} : image processing; A_{30} : Mars/Lunar construction
250	$Tb_{10}A_{52}$	-	bm_{10}	-	bm_{10} : position + internal + error + force; A_{52} : measurement
251	Tb_4A_9	-	bm_4	-	bm_4 : motion + force + transmissibility; A_9 : tunnel construction
252	Tb_3A_{10}	-	bm_5	-	bm_5 : safety + posture load + working environment + risk exposure time+ safety; A_{10} : glass installation
253	$Tm_{119}A_{56}$	a_2	-	hc_1	a_2 : hydraulic; hc_1 : remote + operator; A_{56} : remote construction

254	$Tm_{68}A_{33}$	a_2	hd_{45}	hc_2	a_2 : hydraulic; hd_{45} : wearable; hc_2 : automatic; A_{33} : reduce lifting workload
255	$Tm_{20}A_{12}$	a_3	hd_{57}	hc_2	a_3 : motor; hd_{57} : wire, cable climb; hc_2 : automatic; A_{12} : bridge construction
256	$Tm_{10}A_{19}$	a_3	hd_{16}	hc_2	a_3 : motor; hd_{16} : climbing platform + pediculate + gripper; hc_2 : automatic
257	Tm_4A_{20}	a_3	hd_2	hc_2	a_3 : motor; hd_2 : arm, manipulator + mounted; hc_2 : automatic; A_{20} : spraying
258	$Tm_{97}A_{45}$	a_5	hd_{26}	hc_2	a_5 : pneumatic + motor; hd_{26} : rail, vertical-moving robot; hc_2 : automatic; A_{45} : cleaning
259	$Tm_{148}A_8$	a_6	hd_{24}	hc_2	a_6 : cable driven; hd_{24} : climbing system; hc_2 : automatic; A_8 : steel construction
260	$Tm_{26}A_{17}$	-	hd_{49}	hc_2	hd_{49} : robotized crane; hc_2 : automatic; A_{17} : high rise building construction
261	$Tm_{28}A_{17}$	-	-	hc_2	hc_2 : automatic; A_{17} : high rise building construction
262	$Tm_{28}A_{19}$	-	-	hc_2	hc_2 : automatic; A_{19} : building maintenance
263	$Tm_{28}A_{38}$	-	-	hc_2	hc_2 : automatic
264	$Tm_{153}A_6$	a_3	hd_2	-	hd_2 : arm, manipulator + mounted; A_6 : building inspection
265	$Tm_{82}A_{41}$	a_2	hd_{61}	hc_2	a_2 : hydraulic; hd_{61} : excavator arm + double front; hc_2 : automatic; A_{41} : waste collection
266	$Tc_{25}A_9$	s_{39}	ca_{115}	-	s_{39} : camera + image + CCD + Kinect; ca_{115} : self-positioning algorithm; A_9 : tunnel construction
267	$Tc_{13}A_{38}$	-	ca_{115}	-	ca_{115} : self-positioning algorithm; A_{38} : marking
268	$Tc_{13}A_{54}$	-	ca_{115}	-	ca_{115} : self-positioning algorithm; A_{54} : arc welding
269	$Tc_{125}A_{38}$	-	ca_{119}	-	ca_{119} : error modification; A_{38} : marking
270	$Tc_{165}A_{54}$	s_{16}	ca_{19}	-	s_{16} : CCD camera + stereo sensor; A_{54} : arc welding
271	$Tc_{189}A_{56}$	-	ca_{26}	-	ca_{26} : fusion fuzzy, fuzzy logic, fuzzy set theory; A_{56} : remote construction
272	$Tc_{10}A_{11}$	s_{25}	ca_{29}	-	s_{25} : infrared distance sensors + camera; ca_{29} : planning stigmergy + Linux-based computer; A_{11} : wall construction
273	$Tc_{68}A_{22}$	s_{72}	ca_3	-	s_{72} : camera + proximity sensor + F/T sensor ca_3 : analytical model; A_{22} : masonry construction
274	$Tc_{184}A_{56}$	-	ca_{62}	-	ca_{62} : image processing; A_{56} : remote construction
275	$Tc_{48}A_{17}$	s_{119}	ca_{67}	-	s_{119} : optical (IR) sensor; ca_{67} : Kalman Filter Algorithm; A_{17} : high rise building construction
276	$Tc_{100}A_{32}$	s_{14}	ca_{73}	-	s_{14} : laser; ca_{73} : Machine Learning; A_{32} : machinery navigation
277	$Tc_{191}A_{56}$	-	ca_{84}	-	ca_{84} : Force feedback control; A_{56} : remote construction
278	$Tc_{86}A_{25}$	-	ca_{86}	-	ca_{86} : master-slave system; A_{25} : grasp soft objects
279	$Tc_{86}A_{25}$	-	ca_{86}	-	ca_{86} : master-slave system; A_{25} : grasp soft objects

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280	$Tc_{86}A_{25}$	-	ca_{86}	-	ca_{86} : master-slave system; A_{25} : grasp soft objects
281	$Tc_{35}A_{12}$	s_{14}	ca_{90}	-	s_{14} : laser; ca_{90} : C++, Java, C# script, C program; A_{12} : bridge construction
282	$Tb_{11}A_{56}$	-	bm_{11}	-	bm_{11} : grasping + force + perception; A_{56} : remote construction
283	$Tm_{115}A_{55}$	a_3	bd_4	bc_2	a_3 : motor; bd_4 : arm + slider pulley; bc_2 : automatic; A_{55} : underwater work
284	$Tm_{27}A_{28}$	a_3	bd_{46}	bc_2	a_3 : motor; bd_{46} : wheel + magnetic gripper; bc_2 : automatic; A_{28} : ceiling construction
285	$Tm_{129}A_6$	a_3	bd_{74}	bc_2	a_3 : motor; bd_{74} : worm-like, snake-like robot; bc_2 : automatic; A_6 : building inspection
286	$Tm_{22}A_6$	a_3	bd_{32}	bc_2	a_3 : motor; bd_{32} : wheel mobile; bc_2 : automatic; A_6 : building inspection
287	$Tm_{28}A_{38}$	-	-	bc_2	bc_2 : automatic; A_{38} : marking
288	$Tm_{63}A_3$	a_3	bd_{32}	bc_3	a_3 : motor; bd_{32} : wheel mobile; bc_3 : human-robot + collaboration; A_3 : building service
289	$Tm_{64}A_{10}$	-	bd_{30}	bc_3	bd_{30} : industrial robot; bc_3 : human-robot + collaboration; A_{10} : glass installation
290	$Tc_{84}A_{29}$	-	ca_{10}	-	ca_{10} : heuristic algorithm, heuristics; A_{29} : material, sorting, delivery, distribution
291	$Tc_{109}A_{32}$	-	ca_{112}	-	ca_{112} : Ubiquitous Sensor Network; A_{32} : machinery navigation
292	$Tc_{53}A_{19}$	s_{54}	ca_{116}	-	s_{54} : laser + cameras + Kinect; ca_{116} : segmentation approach; A_{19} : building maintenance
293	$Tc_{18}A_{11}$	s_{26}	ca_{30}	-	s_{26} : shock sensor + infrared ray sensor + laser sensor, magnetic sensor; ca_{30} : encoder failure detection algorithm; A_{11} : wall construction
294	$Tc_{157}A_{50}$	-	ca_{37}	-	ca_{37} : intelligent beacon; A_{50} : operation simulation
295	$Tc_{62}A_{20}$	s_{37}	ca_{40}	-	s_{37} : ultrasonic sensor + 2D LIDAR; ca_{40} : collision avoidance algorithms, feed forward control algorithms; A_{20} : spraying
296	$Tc_{33}A_{24}$	-	ca_{49}	-	ca_{49} : genetic algorithms (GA); A_{24} : machinery path management
297	$Tc_{87}A_{37}$	s_8	ca_5	-	s_8 : pressure sensor; ca_5 : PI controller, active control algorithm; A_{37} : timer construction
298	$Tc_{96}A_{31}$	-	ca_{54}	-	ca_{54} : inverse position equation; A_{31} : slab finishing
299	$Tc_{27}A_{56}$	-	ca_{90}	-	ca_{90} : C++, Java, C# script, C program; A_{56} : remote construction
300	$Tc_{114}A_{34}$	s_{54}	ca_{95}	-	s_{54} : laser + cameras + Kinect; ca_{95} : PLC; A_{34} : components assemble
301	$Tb_{10}A_{35}$	-	bm_{10}	-	bm_{10} : position + internal + error + force; A_{35} : construction activity evaluation
302	$Tm_{107}A_5$	-	-	bc_1	bc_1 : remote + operator; A_5 : earthmoving construction
303	$Tm_{13}A_{29}$	a_3	bd_7	bc_2	bd_7 : gantry robot, arm; bc_2 : automatic; A_{29} : material, sorting, delivery, distribution
304	$Tm_{140}A_{63}$	a_6	bd_{57}	bc_2	a_6 : cable driven; bd_{57} : wire, cable climb; bc_2 : automatic; A_6 : building inspection; A_{63} : contour crafting
305	$Tm_{51}A_7$	-	bd_{30}	bc_2	bd_{30} : industrial robot; bc_2 : automatic; A_7 : excavation

306	$Tm_{147}A_8$	a_2	hd_7	bc_3	a_2 : hydraulic; hd_7 : gantry robot, arm; bc_3 : human-robot + collaboration; A_8 : steel construction
307	$Tm_{149}A_{10}$	a_3	hd_{62}	bc_3	a_3 : motor; hd_{62} : caterpillar + 6-DOF manipulator + vacuum pad; bc_3 : human-robot + collaboration; A_{10} : glass installation
308	Tm_8A_8	a_3	hd_2	bc_3	a_3 : motor; hd_2 : arm, manipulator + mounted; bc_3 : human-robot + collaboration; A_8 : steel construction
309	$Tm_{58}A_{28}$	-	hd_{44}	bc_3	hd_{44} : manipulator + vacuum suction + wheel mobility; bc_3 : human-robot + collaboration; A_{28} : ceiling construction
310	$Tm_{64}A_{10}$	-	hd_{30}	bc_3	hd_{30} : industrial robot; bc_3 : human-robot + collaboration; A_{10} : glass installation
311	$Tc_{34}A_{29}$	s_{39}	ca_{112}	-	s_{39} : camera + image + CCD + Kinect; ca_{112} : Ubiquitous Sensor Network; A_{29} : material, sorting, delivery, distribution
312	$Tc_{156}A_{50}$	s_{39}	ca_{26}	-	s_{39} : camera + image + CCD + Kinect; ca_{26} : fusion fuzzy, fuzzy logic, fuzzy set theory; A_{50} : operation simulation
313	$Tc_{160}A_{50}$	-	ca_{45}	-	ca_{45} : discrete event simulation model; A_{50} : operation simulation
314	$Tc_{160}A_{50}$	-	ca_{45}	-	ca_{45} : discrete event simulation model; A_{50} : operation simulation
315	$Tc_{58}A_2$	s_{64}	ca_{60}	-	s_{64} : force + laser; ca_{60} : workflow method; A_2 : titling placing
316	$Tc_{185}A_{56}$	s_{136}	ca_{62}	-	s_{136} : camera + position + pressure; ca_{62} : image processing; A_{56} : remote construction
317	$Tc_{66}A_{21}$	s_{39}	ca_{62}	-	s_{39} : camera + image + CCD + Kinect; ca_{62} : image processing; A_{21} : pipe construction
318	$Tc_{21}A_{34}$	-	ca_{75}	-	ca_{75} : IFC + BIM; A_{34} : components assemble
319	$Tc_{228}A_8$	s_{92}	ca_{92}	-	s_{92} : robust sensor + pressure sensors + force sensors; ca_{92} : Virtual Reality; A_8 : steel construction
320	$Tc_{30}A_{12}$	s_{39}	ca_{98}	-	s_{39} : camera + image + CCD + Kinect; ca_{98} : tree-Based algorithm; A_{12} : bridge construction
321	$Tc_{113}A_{34}$	-	ca_{98}	-	ca_{98} : tree-Based algorithm; A_{34} : components assemble
322	$Tm_{137}A_{55}$	a_2	hd_2	bc_1	a_2 : hydraulic; hd_2 : arm, manipulator + mounted; bc_1 : remote + operator; A_{55} : underwater work
323	$Tm_{131}A_6$	a_3	hd_{71}	bc_2	a_3 : motor; hd_{71} : wheel + platform + caterpillar; bc_2 : automatic; A_6 : building inspection
324	$Tm_{121}A_{57}$	a_3	hd_{83}	bc_2	a_3 : motor; hd_{83} : furniture system, terminal wall system; bc_2 : automatic; A_{57} : improve home living environment
325	$Tm_{47}A_5$	a_3	hd_{58}	bc_2	a_3 : motor; hd_{58} : UAV; bc_2 : automatic; A_5 : earthmoving construction
326	Tm_4A_6	a_3	hd_2	bc_2	a_3 : motor; hd_2 : arm, manipulator + mounted; bc_2 : automatic; A_6 : building inspection
327	$Tm_{31}A_2$	-	hd_1	bc_2	hd_1 : humanoid; bc_2 : automatic; A_2 : titling placing
328	$Tm_{26}A_{10}$	-	hd_{49}	bc_2	hd_{49} : robotized crane; bc_2 : automatic; A_{10} : glass installation
329	$Tm_{46}A_{34}$	-	hd_{58}	bc_2	hd_{58} : UAV; bc_2 : automatic; A_{34} : components assemble
330	$Tm_{105}A_{47}$	a_2	hd_2	bc_3	a_2 : hydraulic; hd_2 : arm, manipulator + mounted; bc_3 : human-robot + collaboration; A_{47} : mining
331	$Tm_{72}A_{34}$	-	hd_{42}	bc_3	hd_{42} : mobile vehicle + aerial lift + manipulator + vacuum suction device; bc_3 : human-robot + collaboration; A_{34} : components assemble

332	$Tc_{67}A_{21}$	-	ca_{101}	-	ca_{101} : robust algorithm; A_{21} : pipe construction
333	$Tc_{111}A_{32}$	s_{143}	ca_{105}	-	s_{143} : GPS + IMU; ca_{105} : A* algorithm, A-star; A_{32} : machinery navigation
334	$Tc_{40}A_{14}$	s_{127}	ca_{113}	-	s_{127} : 3D sensor; ca_{113} : velocity control; A_{14} : equipment positioning
335	$Tc_{158}A_{52}$	s_6	ca_{113}	-	s_6 : torque/force sensor + force sensor; ca_{113} : velocity control; A_{52} : measurement
336	$Tc_{108}A_{34}$	s_{54}	ca_{118}	-	s_{54} : laser + cameras + Kinect; ca_{118} : SLAM; A_{34} : components assemble
337	$Tc_{135}A_{54}$	s_{39}	ca_{20}	-	s_{39} : camera + image + CCD + Kinect; ca_{20} : vision based gesture estimation, CARLoS Scenario; A_{54} : arc welding
338	$Tc_{61}A_{20}$	s_{39}	ca_{41}	-	s_{39} : camera + image + CCD + Kinect; ca_{41} : timing algorithm; A_{20} : spraying
339	$Tc_{85}A_{25}$	-	ca_{50}	-	ca_{50} : kinematic connection; A_{25} : grasp soft objects
340	$Tc_{21}A_{22}$	-	ca_{75}	-	ca_{75} : IFC + BIM; A_{22} : masonry construction
341	$Tc_{199}A_{56}$	s_{39}	ca_{80}	-	s_{39} : camera + image + CCD + Kinect; ca_{80} : augmented reality techniques (AR); A_{56} : remote construction
342	$Tc_{202}A_{56}$	s_{136}	ca_{86}	-	s_{136} : camera + position + pressure; ca_{86} : master-slave system; ca_{86} : master-slave system; A_{56} : remote construction
343	$Tb_{12}A_{35}$	-	bm_{12}	-	bm_{12} : sustainability + performance + environment; A_{35} : construction activity evaluation
344	$Tm_{30}A_{19}$	a_2	hd_{57}	hc_2	a_2 : hydraulic; hd_{57} : wire, cable climb; hc_2 : automatic; A_{19} : building maintenance
345	$Tm_{116}A_{55}$	a_3	hd_5	hc_2	a_3 : motor; hd_5 : multi-fingered, hand + gear + belt; hc_2 : automatic; A_{55} : underwater work
346	$Tm_{121}A_{57}$	a_3	hd_{83}	hc_2	a_3 : motor; hd_{83} : furniture system, terminal wall system; hc_2 : automatic; A_{57} : improve home living environment
347	Tm_2A_6	a_3	hd_{52}	hc_2	a_3 : motor; hd_{52} : mobile vehicle; hc_2 : automatic; A_6 : building inspection
348	$Tm_{52}A_{29}$	a_6	hd_{13}	hc_2	a_6 : cable driven; hd_{13} : mobile platform + arm, manipulator; hc_2 : automatic; A_{29} : material, sorting, delivery, distribution
349	$Tm_{43}A_{22}$	-	hd_{54}	hc_2	hd_{54} : vacuum gripper + arm; hc_2 : automatic; A_{22} : masonry construction
350	$Tm_{29}A_{28}$	a_3	hd_{45}	hc_3	hd_{45} : wearable; hc_3 : human-robot + collaboration; A_{28} : ceiling construction
351	$Tc_{136}A_{14}$	s_{126}	ca_{108}	-	s_{126} : laser + camera + tempo sonics; ca_{108} : positioning system; A_{14} : equipment positioning
352	$Tc_{177}A_{56}$	s_6	ca_{20}	-	s_6 : torque/force sensor + force sensor; ca_{20} : vision based gesture estimation, CARLoS Scenario; A_{56} : remote construction
353	$Tc_{122}A_{54}$	-	ca_{21}	-	ca_{21} : optimizing welding sequence; A_{54} : arc welding
354	$Tc_{180}A_{55}$	-	ca_3	-	ca_3 : analytical model; A_{55} : underwater work
355	$Tc_{45}A_{18}$	s_{39}	ca_{44}	-	s_{39} : camera + image + CCD + Kinect; ca_{44} : 3D printer control; A_{18} : large-scale building construction
356	$Tc_{148}A_{29}$	s_{85}	ca_{73}	-	s_{85} : pressure sensor + speed sensor + proximity sensors; ca_{73} : Machine Learning; A_{29} : material, sorting, delivery, distribution
357	$Tc_{76}A_{34}$	-	ca_{73}	-	ca_{73} : Machine Learning; A_{34} : components assemble

358	$Tc_{21}A_{22}$	-	ca_{75}	-	ca_{75} : IFC + BIM; A_{22} : masonry construction
359	$Tc_{195}A_{56}$	-	ca_{78}	-	ca_{78} : torque measure methods; A_{56} : remote construction
360	$Tc_{203}A_{56}$	s_{39}	ca_{86}	-	s_{39} : camera + image + CCD + Kinect; ca_{86} : master-slave system; A_{56} : remote construction
361	$Tc_{218}A_{61}$	-	ca_9	-	ca_9 : performance test, evaluation; cc
362	$Tc_{28}A_{12}$	s_{96}	ca_{99}	-	s_{96} : camera + accelerometers; ca_{99} : dedicated smart sensors; A_{12} : bridge construction
363	Tb_6A_{12}	-	bm_6	-	bm_6 : cost + quality; A_{12} : bridge construction
364	$Tm_{108}A_5$	a_2	bd_{32}	bc_1	a_2 : hydraulic; bd_{32} : wheel mobile; bc_1 : remote + operator; A_5 : earthmoving construction
365	$Tm_{136}A_6$	a_3	bd_{19}	bc_1	a_3 : motor; bd_{19} : climbing platforms + vacuum grippers + suction; bc_1 : remote + operator; A_6 : building inspection
366	$Tm_{120}A_{56}$	a_3	bd_{32}	bc_1	a_3 : motor; bd_{32} : wheel mobile; bc_1 : remote + operator; A_{56} : remote construction
367	$Tm_{110}A_{50}$	a_4	bd_{52}	bc_1	a_4 : electro + hydraulic; bd_{52} : mobile vehicle; bc_1 : remote + operator; A_{50} : operation simulation
368	$Tm_{44}A_{22}$	a_6	bd_{26}	bc_2	a_6 : cable driven; bd_{26} : rail, vertical-moving robot; bc_2 : automatic; A_{22} : masonry construction
369	$Tm_{109}A_{37}$	-	bd_{78}	bc_2	bd_{78} : collaborative, multi, team, multiple; bc_2 : automatic; A_{37} : timer construction
370	$Tm_{109}A_{50}$	-	bd_{78}	bc_2	bd_{78} : collaborative, multi, team, multiple; bc_2 : automatic; A_{50} : operation simulation
371	$Tm_{14}A_{37}$	-	bd_7	bc_2	bd_7 : gantry robot, arm; bc_2 : automatic; A_{37} : timer construction
372	$Tm_{23}A_{29}$	-	bd_{32}	bc_2	bd_{32} : wheel mobile; bc_2 : automatic; A_{29} : material, sorting, delivery, distribution
373	$Tm_{74}A_{34}$	a_3	bd_9	bc_3	a_3 : motor; bc_3 : human-robot + collaboration; A_{34} : components assemble
374	$Tm_{29}A_{29}$	a_3	bd_{45}	bc_3	a_3 : motor; bd_{45} : wearable; bc_3 : human-robot + collaboration; A_{29} : material, sorting, delivery, distribution
375	$Tm_{73}A_{34}$	-	bd_{30}	bc_3	bd_{30} : industrial robot; bc_3 : human-robot + collaboration; A_{34} : components assemble
376	$Tc_{83}A_{24}$	s_{39}	ca_{105}	-	s_{39} : camera + image + CCD + Kinect; ca_{105} : A* algorithm, A-star; A_{24} : machinery path management
377	$Tc_{110}A_{32}$	s_{14}	ca_{110}	-	s_{14} : laser; ca_{110} : Iterative Closest Point (ICP) algorithm; ca_{110} : Iterative Closest Point (ICP) algorithm; A_{32} : machinery navigation
378	$Tc_{234}A_{52}$	s_6	ca_{114}	-	s_6 : torque/force sensor + force sensor; ca_{114} : behaviour-based system; A_{52} : measurement
379	$Tc_{16}A_{58}$	-	ca_{32}	-	ca_{32} : parametric-integrated algorithm, parametric synthesis; A_{58} : finishing
380	$Tc_{238}A_{55}$	-	ca_4	-	ca_4 : estimate ego-position; A_{55} : underwater work
381	$Tc_{44}A_{16}$	-	ca_{44}	-	ca_{44} : 3D printer control; A_{16} : concrete printing
382	$Tc_{44}A_{16}$	-	ca_{44}	-	ca_{44} : 3D printer control; A_{16} : concrete printing
383	$Tc_{44}A_{16}$	-	ca_{44}	-	ca_{44} : 3D printer control; A_{16} : concrete printing

384	$Tc_{44}A_{16}$	-	ca_{44}	-	ca_{44} : 3D printer control; A_{16} : concrete printing
385	$Tc_{87}A_{55}$	s_8	ca_5	-	s_8 : pressure sensor; ca_5 : PI controller, active control algorithm; A_{55} : underwater work
386	$Tc_{217}A_{60}$	-	ca_{57}	-	ca_{57} : C-K Theory; A_{60} : drilling
387	$Tc_{176}A_{55}$	s_6	ca_6	-	s_6 : torque/force sensor + force sensor; ca_6 : pure-pursuit method; A_{55} : underwater work
388	$Tc_{77}A_{22}$	-	ca_{72}	-	ca_{72} : Particle Swarm Optimization (PSO) algorithms; A_{22} : masonry construction
389	$Tc_{223}A_{50}$	s_{43}	ca_{73}	-	s_{43} : joint sensor; ca_{73} : Machine Learning; ca_{73} : Machine Learning; A_{50} : operation simulation
390	$Tc_{73}A_8$	s_{14}	ca_{75}	-	s_{14} : laser; ca_{75} : IFC + BIM; A_8 : steel construction
391	$Tc_{21}A_3$	-	ca_{75}	-	ca_{75} : IFC + BIM; A_3 : building service
392	$Tc_{120}A_{34}$	s_{127}	ca_{82}	-	s_{127} : 3D sensor; ca_{82} : Generalized Resolution Correlative Scan Matching (GRCSM); A_{34} : components assemble
393	$Tc_{204}A_{56}$	s_{137}	ca_{86}	-	s_{137} : position sensors + magnetic stroke sensors + pressure sensors; ca_{86} : master-slave system; ca_{86} : master-slave system; A_{56} : remote construction
394	$Tc_{27}A_{34}$	-	ca_{90}	-	ca_{90} : C++, Java, C# script, C program; A_{34} : components assemble
395	$Tc_{221}A_{62}$	s_{39}	ca_{94}	-	s_{39} : camera + image + CCD + Kinect; ca_{94} : Raspberry Pi; A_{62} : fire curtain testing
396	$Tc_{98}A_{32}$	s_{82}	ca_{96}	-	s_{82} : laser + lidar; ca_{96} : real time navigation; ca_{96} : real time navigation; A_{32} : machinery navigation
397	Tb_1A_{11}	-	bm_1	-	bm_1 : environmental + life cycle Assessment (LCA); A_{11} : wall construction
398	$Tm_{104}A_{45}$	a_3	bd_{35}	bc_1	bd_{35} : bucket + arm; bc_1 : remote + operator; A_{45} : cleaning
399	$Tm_{138}A_6$	a_3	bd_2	bc_1	bd_2 : arm, manipulator + mounted; bc_1 : remote + operator; A_6 : building inspection
400	$Tm_{65}A_{30}$	a_1	bd_{70}	bc_2	a_1 : pneumatic; bd_{70} : mobility feet, leg, limbed; bc_2 : automatic; A_{30} : Mars/Lunar construction
401	$Tm_{45}A_{22}$	a_3	bd_{59}	bc_2	a_3 : motor; bd_{59} : scissor lift + aerial bucket + manipulator arm; bc_2 : automatic; A_{22} : masonry construction
402	$Tm_{47}A_6$	a_3	bd_{58}	bc_2	a_3 : motor; bd_{58} : UAV; bc_2 : automatic; A_6 : building inspection
403	$Tm_{22}A_{15}$	a_3	bd_{32}	bc_2	a_3 : motor; bd_{32} : wheel mobile; bc_2 : automatic; A_{15} : building quality assessment
404	$Tm_{22}A_6$	a_3	bd_{32}	bc_2	a_3 : motor; bd_{32} : wheel mobile; bc_2 : automatic; A_6 : building inspection
405	$Tm_{16}A_{11}$	a_6	bd_{25}	bc_2	a_6 : cable driven; bd_{25} : parallel robot; bc_2 : automatic; A_{11} : wall construction
406	$Tm_{15}A_{11}$	-	bd_{23}	bc_2	bd_{23} : mobile + light + manipulator + rail; bc_2 : automatic; A_{11} : wall construction
407	$Tm_{67}A_{60}$	-	bd_{75}	bc_2	bd_{75} : clamping manipulator; bc_2 : automatic; A_{60} : drilling
408	$Tm_{111}A_{52}$	-	bd_{16}	bc_2	bd_{16} : climbing platform + pediculate + gripper; bc_2 : automatic; A_{52} : measurement
409	$Tm_{46}A_6$	-	bd_{58}	bc_2	bd_{58} : UAV; bc_2 : automatic; A_6 : building inspection

410	$Tm_{23}A_{15}$	-	hd_{32}	hc_2	hd_{32} : wheel mobile; hc_2 : automatic; A_{15} : building quality assessment
411	$Tm_{77}A_9$	-	hd_2	hc_2	hd_2 : arm, manipulator + mounted; hc_2 : automatic; A_9 : tunnel construction
412	$Tm_{28}A_6$	-	-	hc_2	hc_2 : automatic; A_6 : building inspection
413	$Tm_{75}A_{34}$	a_5	hd_7	hc_3	hd_7 : gantry robot, arm; A_{34} : components assemble
414	$Tm_{64}A_3$	-	hd_{30}	hc_3	hd_{30} : industrial robot; hc_3 : human-robot + collaboration; A_3 : building service
415	$Tc_{99}A_{32}$	s_{109}	ca_{103}	-	s_{109} : GPS + camera; ca_{103} : motion planning; A_{32} : machinery navigation
416	Tc_{84}	-	ca_{103}	-	ca_{103} : motion planning; A_{24} : machinery path management
417	$Tc_{84}A_{33}$	-	ca_{103}	-	ca_{103} : motion planning; A_{33} : reduce lifting workload
418	$Tc_{84}A_{45}$	-	ca_{103}	-	ca_{103} : motion planning; A_{45} : cleaning
419	$Tc_{142}A_{46}$	s_{14}	ca_{110}	-	s_{14} : laser; ca_{110} : Iterative Closest Point (ICP) algorithm; A_{46} : machinery mapping
420	$Tc_{174}A_{55}$	-	ca_{113}	-	ca_{113} : velocity control; A_{55} : underwater work
421	$Tc_{107}A_{32}$	s_{29}	ca_{118}	-	s_{29} : camera + laser + lidar; ca_{118} : SLAM; A_{32} : machinery navigation
422	$Tc_{38}A_{32}$	s_{39}	ca_{118}	-	s_{39} : camera + image + CCD + Kinect; ca_{118} : SLAM; A_{32} : machinery navigation
423	$Tc_{38}A_{32}$	s_{39}	ca_{118}	-	s_{39} : camera + image + CCD + Kinect; ca_{118} : SLAM; A_{32} : machinery navigation
424	$Tc_{233}A_{43}$	s_6	ca_{17}	-	s_6 : torque/force sensor + force sensor; ca_{17} : admittance control; A_{43} : joint filling
425	$Tc_{17}A_{11}$	s_{28}	ca_{31}	-	s_{28} : alignment sensor + brake check sensor + obstacle detecting sensors + laser sensors + ultrasonic sensor + HMR sensor; ca_{31} : wireless communication + wireless Lan; A_{11} : wall construction
426	$Tc_{225}A_7$	s_{48}	ca_{31}	-	s_{48} : work environment sensors + GPS + IMU + lidar; ca_{31} : wireless communication + wireless Lan; A_7 : excavation
427	$Tc_{45}A_{18}$	s_{39}	ca_{44}	-	s_{39} : camera + image + CCD + Kinect; ca_{44} : 3D printer control; A_{18} : large-scale building construction
428	$Tc_{50}A_{18}$	s_{48}	ca_{44}	-	s_{48} : work environment sensors + GPS + IMU + lidar; ca_{44} : 3D printer control; A_{18} : large-scale building construction
429	$Tc_{178}A_{55}$	s_6	ca_5	-	s_6 : torque/force sensor + force sensor; ca_5 : PI controller, active control algorithm; A_{55} : underwater work
430	$Tc_{103}A_{32}$	s_{109}	ca_{73}	-	s_{109} : GPS + camera; ca_{73} : Machine Learning; A_{32} : machinery navigation
431	$Tc_{150}A_{50}$	s_{146}	ca_{73}	-	s_{146} : Kinect + accelerometers + IMUs; ca_{73} : Machine Learning; A_{50} : operation simulation
432	$Tc_{127}A_{39}$	s_{158}	ca_{73}	-	s_{158} : depth sensor + colour sensors + camera; ca_{73} : Machine Learning; A_{39} : hazard detection
433	$Tc_{32}A_{51}$	s_{39}	ca_{73}	-	s_{39} : camera + image + CCD + Kinect; ca_{73} : Machine Learning; A_{51} : pose estimation
434	$Tc_{32}A_{59}$	s_{39}	ca_{73}	-	s_{39} : camera + image + CCD + Kinect; ca_{73} : Machine Learning; A_{59} : object recognition
435	$Tc_{32}A_6$	s_{39}	ca_{73}	-	s_{39} : camera + image + CCD + Kinect; ca_{73} : Machine Learning; A_6 : building inspection

436	$Tc_{76}A_{36}$	-	ca_{73}	-	ca_{73} : Machine Learning; A_{36} : diagnosis detection
437	$Tc_{76}A_{36}$	-	ca_{73}	-	ca_{73} : Machine Learning; A_{36} : diagnosis detection
438	$Tc_{73}A_{22}$	s_{14}	ca_{75}	-	s_{14} : laser; ca_{75} : IFC + BIM; A_{22} : masonry construction
439	$Tc_{37}A_{13}$	s_{29}	ca_{75}	-	s_{29} : camera + laser + lidar; ca_{75} : IFC + BIM; A_{13} : construction monitoring
440	$Tc_{21}A_{15}$	-	ca_{75}	-	ca_{75} : IFC + BIM; A_{15} : building quality assessment
441	$Tc_{21}A_{15}$	-	ca_{75}	-	ca_{75} : IFC + BIM; A_{15} : building quality assessment
442	$Tc_{21}A_{63}$	-	ca_{75}	-	ca_{75} : IFC + BIM; A_{63} : contour crafting
443	$Tc_{21}A_9$	-	ca_{75}	-	ca_{75} : IFC + BIM; A_9 : tunnel construction
444	$Tc_{198}A_{55}$	s_6	ca_{79}	-	s_6 : torque/force sensor + force sensor; ca_{79} : RBF-PID Control; A_{55} : underwater work
445	$Tc_{12}A_{43}$	s_{129}	ca_{82}	-	s_{129} : optical + ultrasonic + laser; ca_{82} : Generalized Resolution Correlative Scan Matching (GRCSM); A_{43} : joint filling
446	$Tc_{12}A_{43}$	s_{129}	ca_{82}	-	s_{129} : optical + ultrasonic + laser; ca_{82} : Generalized Resolution Correlative Scan Matching (GRCSM); A_{43} : joint filling
447	$Tc_{69}A_{22}$	-	ca_{82}	-	ca_{82} : Generalized Resolution Correlative Scan Matching (GRCSM); A_{22} : masonry construction
448	$Tc_{203}A_{56}$	s_{39}	ca_{86}	-	s_{39} : camera + image + CCD + Kinect; ca_{86} : master-slave system; A_{56} : remote construction
449	$Tc_{86}A_{34}$	-	ca_{86}	-	ca_{86} : master-slave system; A_{34} : components assemble
450	$Tc_{173}A_{55}$	s_6	ca_9	-	s_6 : torque/force sensor + force sensor; ca_9 : performance test, evaluation; A_{55} : underwater work
451	$Tb_{14}A_{35}$	-	bm_{14}	-	bm_{14} : cost + productivity + efficiency; A_{35} : construction activity evaluation
452	$Tb_{15}A_{16}$	-	bm_{15}	-	bm_{15} : mental workload; A_{16} : concrete printing
453	$Tm_{99}A_{45}$	a_3	bd_{37}	bc_2	a_3 : motor; bd_{37} : reconfigurable + platform; bc_2 : automatic; A_{45} : cleaning
454	$Tm_{154}A_6$	a_3	bd_{46}	bc_2	a_3 : motor; bd_{46} : wheel + magnetic gripper; bc_2 : automatic; A_6 : building inspection
455	$Tm_{98}A_{45}$	a_3	bd_{19}	bc_2	a_3 : motor; bd_{19} : climbing platforms + vacuum grippers + suction; bc_2 : automatic; A_{45} : cleaning
456	$Tm_{133}A_6$	a_3	bd_3	bc_2	a_3 : motor; bd_3 : crawler; bc_2 : automatic; A_6 : building inspection
457	Tm_2A_6	a_3	bd_{52}	bc_2	a_3 : motor; bd_{52} : mobile vehicle; bc_2 : automatic
458	$Tm_{22}A_6$	a_3	bd_{32}	bc_2	a_3 : motor; bd_{32} : wheel mobile; bc_2 : automatic; A_6 : building inspection
459	Tm_4A_6	a_3	bd_2	bc_2	a_3 : motor; bd_2 : arm, manipulator + mounted; bc_2 : automatic; A_6 : building inspection
460	$Tm_{42}A_{22}$	a_6	bd_{53}	bc_2	a_6 : cable driven; bd_{53} : wireless gripper, winch; bc_2 : automatic; A_{22} : masonry construction
461	$Tm_{44}A_{22}$	a_6	bd_{26}	bc_2	a_6 : cable driven; bd_{26} : rail, vertical-moving robot; bc_2 : automatic; A_{22} : masonry construction

462	$Tm_{16}A_{11}$	a_6	bd_{25}	bc_2	a_6 : cable driven; bd_{25} : parallel robot; bc_2 : automatic; A_{11} : wall construction
463	$Tm_{76}A_{34}$	a_6	bd_{25}	bc_2	a_6 : cable driven; bd_{25} : parallel robot; bc_2 : automatic; A_{34} : components assemble
464	$Tm_{114}A_{54}$	-	bd_{14}	bc_2	bd_{14} : changeable cell; bc_2 : automatic; A_{54} : arc welding
465	$Tm_{132}A_6$	-	bd_{72}	bc_2	bd_{72} : Hammering; bc_2 : automatic; A_6 : building inspection
466	$Tm_{132}A_6$	-	bd_{72}	bc_2	bd_{72} : Hammering; bc_2 : automatic; A_6 : building inspection
467	Tm_6A_{11}	-	bd_{13}	bc_2	bd_{13} : mobile platform + arm, manipulator; bc_2 : automatic; A_{11} : wall construction
468	Tm_5A_{11}	-	bd_{27}	bc_2	bd_{27} : AGV, unmanned ground vehicle; bc_2 : automatic; A_{11} : wall construction
469	$Tm_{46}A_{22}$	-	bd_{58}	bc_2	bd_{58} : UAV; bc_2 : automatic; A_{22} : masonry construction
470	$Tm_{23}A_{30}$	-	bd_{32}	bc_2	bd_{32} : wheel mobile; bc_2 : automatic; A_{30} : Mars/Lunar construction
471	$Tm_{77}A_6$	-	bd_2	bc_2	bd_2 : arm, manipulator + mounted; bc_2 : automatic; A_6 : building inspection
472	$Tm_{28}A_{19}$	-	-	bc_2	bc_2 : automatic; A_{19} : building maintenance
473	$Tm_{28}A_{28}$	-	-	bc_2	bc_2 : automatic; A_{28} : ceiling construction
474	$Tm_{125}A_6$	a_3	bd_{73}	bc_3	a_3 : motor; bd_{73} : magnetic wheel; bc_3 : human-robot + collaboration; A_6 : building inspection
475	$Tc_{212}A_6$	s_{54}	ca_{106}	-	s_{54} : laser + cameras + Kinect; ca_{106} : point cloud data control; A_6 : building inspection
476	$Tc_{131}A_{36}$	s_{39}	ca_{110}	-	s_{39} : camera + image + CCD + Kinect; ca_{110} : Iterative Closest Point (ICP) algorithm; A_{36} : diagnosis detection
477	Tc_9A_{11}	s_{29}	ca_{118}	-	s_{29} : camera + laser + lidar; ca_{118} : SLAM; A_{11} : wall construction
478	$Tc_{123}A_{24}$	s_{48}	ca_{118}	-	s_{48} : work environment sensors + GPS + IMU + lidar; ca_{118} : SLAM; A_{24} : machinery path management
479	$Tc_{108}A_{24}$	s_{54}	ca_{118}	-	s_{54} : laser + cameras + Kinect; ca_{118} : SLAM; A_{24} : machinery path management
480	$Tc_{139}A_{54}$	s_{19}	ca_{22}	-	s_{19} : 3D laser + camera + torch sensor + galvanometer scanner; ca_{22} : BIM+ Augmented Reality+Human-Machine Interfaces (IMUs); A_{54} : arc welding; A_{22} : masonry construction
481	$Tc_{133}A_{33}$	s_{39}	ca_{22}	-	s_{39} : camera + image + CCD + Kinect; ca_{22} : BIM+ Augmented Reality+Human-Machine Interfaces (IMUs); A_{33} : reduce lifting workload
482	$Tc_{159}A_{54}$	-	ca_{23}	-	ca_{23} : power line communication net; A_{54} : arc welding
483	$Tc_{14}A_{11}$	s_{31}	ca_{34}	-	s_{31} : tactile senses + force sensor; ca_{34} : Anderson Passive control theory; A_{11} : wall construction
484	$Tc_{44}A_{11}$	-	ca_{44}	-	ca_{44} : 3D printer control; A_{11} : wall construction
485	$Tc_{44}A_{18}$	-	ca_{44}	-	ca_{44} : 3D printer control; A_{18} : large-scale building construction
486	$Tc_{60}A_2$	s_{14}	ca_{46}	-	s_{14} : laser; ca_{46} : embedded, embedding, controller; A_2 : tiling placing

487	$T_{c60}A_{29}$	s_{14}	ca_{46}	-	s_{14} : laser; ca_{46} : embedded, embedding, controller; A_{29} : material, sorting, delivery, distribution
488	$T_{c90}A_{29}$	s_{39}	ca_{58}	-	s_{39} : camera + image + CCD + Kinect; ca_{58} : soft additive fabrication; A_{29} : material, sorting, delivery, distribution
489	$T_{c102}A_{32}$	s_{39}	ca_{66}	-	s_{39} : camera + image + CCD + Kinect; ca_{66} : geodetical method; A_{32} : machinery navigation
490	$T_{c32}A_{15}$	s_{39}	ca_{73}	-	s_{39} : camera + image + CCD + Kinect; ca_{73} : Machine Learning; A_{15} : building quality assessment
491	$T_{c32}A_{32}$	s_{39}	ca_{73}	-	s_{39} : camera + image + CCD + Kinect; ca_{73} : Machine Learning; A_{32} : machinery navigation
492	$T_{c32}A_{32}$	s_{39}	ca_{73}	-	s_{39} : camera + image + CCD + Kinect; ca_{73} : Machine Learning; A_{32} : machinery navigation
493	$T_{c32}A_{50}$	s_{39}	ca_{73}	-	s_{39} : camera + image + CCD + Kinect; ca_{73} : Machine Learning; A_{50} : operation simulation
494	$T_{c32}A_{51}$	s_{39}	ca_{73}	-	s_{39} : camera + image + CCD + Kinect; ca_{73} : Machine Learning; A_{51} : pose estimation
495	$T_{c4}A_{50}$	s_6	ca_{73}	-	s_6 : torque/force sensor + force sensor; ca_{73} : Machine Learning; A_{50} : operation simulation
496	$T_{c76}A_{22}$	-	ca_{73}	-	ca_{73} : Machine Learning; A_{22} : masonry construction
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499	$T_{c76}A_{36}$	-	ca_{73}	-	ca_{73} : Machine Learning; A_{36} : diagnosis detection
500	$T_{c206}A_{58}$	s_{19}	ca_{75}	-	s_{19} : 3D laser + camera + torch sensor + galvanometer scanner; ca_{75} : IFC + BIM; A_{58} : finishing
501	$T_{c92}A_{30}$	s_{54}	ca_{75}	-	s_{54} : laser + cameras + Kinect; ca_{75} : IFC + BIM; A_{30} : Mars/Lunar construction
502	$T_{c92}A_{38}$	s_{54}	ca_{75}	-	s_{54} : laser + cameras + Kinect; ca_{75} : IFC + BIM; A_{38} : marking
503	$T_{c21}A_{37}$	-	ca_{75}	-	ca_{75} : IFC + BIM; A_{37} : timer construction
504	$T_{c193}A_{56}$	s_{140}	ca_{77}	-	s_{140} : pressure sensor + electronic compass + displacement transducers; ca_{77} : digital signal processing (DSP) controller; A_{56} : remote construction
505	$T_{c163}A_{50}$	s_{84}	ca_{79}	-	s_{84} : GPS + lidar + camera + angle sensors + distance sensors + force sensor + depth sensor + radar, ultrasonic sensors + IMU; ca_{79} : RBF-PID Control; A_{50} : operation simulation
506	$T_{c69}A_{43}$	s_{54}	ca_{82}	-	s_{54} : laser + cameras + Kinect; ca_{82} : Generalized Resolution Correlative Scan Matching (GRCSM); A_{43} : joint filling
507	$T_{c69}A_{43}$	s_{54}	ca_{82}	-	s_{54} : laser + cameras + Kinect; ca_{82} : Generalized Resolution Correlative Scan Matching (GRCSM); A_{43} : joint filling
508	$T_{c235}A_{50}$	-	ca_{83}	-	ca_{83} : finite element method; ca_{83} : finite element method; A_{50} : operation simulation
509	$T_{c146}A_5$	s_{84}	ca_{85}	-	s_{84} : GPS + lidar + camera + angle sensors + distance sensors + force sensor + depth sensor + radar, ultrasonic sensors + IMU; ca_{85} : iterative learning control + fuzzy logic controller; A_5 : earthmoving construction
510	$T_{c146}A_5$	s_{84}	ca_{85}	-	s_{84} : GPS + lidar + camera + angle sensors + distance sensors + force sensor + depth sensor + radar, ultrasonic sensors + IMU; ca_{85} : iterative learning control + fuzzy logic controller; A_5 : earthmoving construction

511	Tc_{86}/A_{16}	-	ca_{86}	-	ca_{86} : master-slave system; A_{16} : concrete printing
512	Tc_8/A_{10}	s_6	ca_{89}	-	s_6 : torque/force sensor + force sensor; ca_{89} : trajectory generation algorithm; A_{10} : glass installation
513	Tb_3/A_{22}	-	bm_3	-	bm_3 : efficiency; A_{22} : masonry construction
514	Tm_{87}/A_{42}	a_2	bd_{61}	bc_1	a_2 : hydraulic; bd_{61} : excavator arm + double front; bc_1 : remote + operator; A_{42} : disaster restoration
515	Tm_{86}/A_{42}	-	bd_3	bc_1	bd_3 : crawler; bc_1 : remote + operator; A_{42} : disaster restoration
516	Tm_{135}/A_6	a_1	bd_{15}	bc_2	a_1 : pneumatic; bd_{15} : wheel mobile lifting single arm; bc_2 : automatic; A_6 : building inspection
517	Tm_{69}/A_{60}	a_2	bd_{76}	bc_2	a_2 : hydraulic; bd_{76} : scissor lifter + omnidirectional wheels; bc_2 : automatic; A_{60} : drilling
518	Tm_{101}/A_{45}	a_3	bd_{38}	bc_2	a_3 : motor; bd_{38} : reconfigurable + vertical + climbing; bc_2 : automatic; A_{45} : cleaning
519	Tm_{100}/A_{45}	a_3	bd_{39}	bc_2	a_3 : motor; bd_{39} : reconfigurable + locomotive wheel; bc_2 : automatic; A_{45} : cleaning
520	Tm_{103}/A_{45}	a_3	bd_{40}	bc_2	a_3 : motor; bd_{40} : caterpillar wheel + commercial impeller, + vacuum suction; bc_2 : automatic; A_{45} : cleaning
521	Tm_{102}/A_{45}	a_3	bd_{41}	bc_2	a_3 : motor; bd_{41} : parallel manipulator, frame; bc_2 : automatic; A_{45} : cleaning
522	Tm_{79}/A_{38}	a_3	bd_{79}	bc_2	a_3 : motor; bd_{79} : omnidirectional wheel; bc_2 : automatic; A_{38} : marking
523	Tm_{79}/A_{38}	a_3	bd_{79}	bc_2	a_3 : motor; bd_{79} : omnidirectional wheel; bc_2 : automatic; A_{38} : marking
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527	Tm_{16}/A_{22}	a_6	bd_{25}	bc_2	a_6 : cable driven; bd_{25} : parallel robot; bc_2 : automatic; A_{22} : masonry construction
528	Tm_{46}/A_6	-	bd_{58}	bc_2	bd_{58} : UAV; bc_2 : automatic; A_6 : building inspection
529	Tm_{51}/A_{22}	-	bd_{30}	bc_2	bd_{30} : industrial robot; bc_2 : automatic; A_{22} : masonry construction
530	Tm_{14}/A_{44}	-	bd_7	bc_2	bd_7 : gantry robot, arm; bc_2 : automatic; A_{44} : panel installation
531	Tm_{77}/A_{37}	-	bd_2	bc_2	bd_2 : arm, manipulator + mounted; bc_2 : automatic; A_{37} : timer construction
532	Tm_{77}/A_{37}	-	bd_2	bc_2	bd_2 : arm, manipulator + mounted; bc_2 : automatic; A_{37} : timer construction
533	Tm_{77}/A_{41}	-	bd_2	bc_2	bd_2 : arm, manipulator + mounted; bc_2 : automatic; A_{41} : waste collection
534	Tm_{28}/A_{30}	-	-	bc_2	bc_2 : automatic; A_{30} : Mars/Lunar construction
535	Tm_{21}/A_{13}	-	bd_{31}	bc_3	bd_{31} : UGV + UAV; bc_3 : human-robot + collaboration; A_{13} : construction monitoring
536	Tc_{208}/A_{59}	s_{54}	ca_{110}	-	s_{54} : laser + cameras + Kinect; ca_{110} : Iterative Closest Point (ICP) algorithm; A_{59} : object recognition

537	$T_{c213}A_6$	s_{79}	ca_{110}	-	s_{79} : lidar + camera; ca_{110} : Iterative Closest Point (ICP) algorithm; A_6 : building inspection
538	$T_{c101}A_{32}$	s_{144}	ca_{118}	-	s_{144} : camera + angle + lidar + GPS; ca_{118} : SLAM; A_{32} : machinery navigation
539	$T_{c101}A_{45}$	s_{144}	ca_{118}	-	s_{144} : camera + angle + lidar + GPS; ca_{118} : SLAM; A_{45} : cleaning
540	$T_{c38}A_{46}$	s_{39}	ca_{118}	-	s_{39} : camera + image + CCD + Kinect; ca_{118} : SLAM; A_{46} : machinery mapping
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543	$T_{c39}A_{14}$	-	ca_{118}	-	ca_{118} : SLAM; A_{14} : equipment positioning
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550	$T_{c85}A_{50}$	-	ca_{50}	-	ca_{50} : kinematic connection; A_{50} : operation simulation
551	$T_{c129}A_{41}$	s_{54}	ca_{64}	-	s_{54} : laser + cameras + Kinect; ca_{64} : iterative algorithms + regression model; A_{41} : waste collection
552	$T_{c116}A_{34}$	-	ca_{70}	-	ca_{70} : PTP control; A_{34} : components assemble
553	$T_{c188}A_{56}$	s_{139}	ca_{73}	-	s_{139} : stereo camera + acceleration sensors + a gyro sensor; ca_{73} : Machine Learning; A_{56} : remote construction
554	$T_{c188}A_{56}$	s_{139}	ca_{73}	-	s_{139} : stereo camera + acceleration sensors + a gyro sensor; ca_{73} : Machine Learning; A_{56} : remote construction
555	$T_{c153}A_{50}$	s_{18}	ca_{73}	-	s_{18} : various sensors + sensor system; ca_{73} : Machine Learning; A_{50} : operation simulation
556	$T_{c32}A_{12}$	s_{39}	ca_{73}	-	s_{39} : camera + image + CCD + Kinect; ca_{73} : Machine Learning; A_{12} : bridge construction
557	$T_{c32}A_{24}$	s_{39}	ca_{73}	-	s_{39} : camera + image + CCD + Kinect; ca_{73} : Machine Learning; A_{24} : machinery path management
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124	Portable robotic system for steel h-beam welding
125	A cleaning robot for construction out-wall with complicated curve surface
126	A remotely controlled robot operates construction machine remote)

127	Manipulators help out with plaster panels in construction
128	Field test of remote control system for construction machines using robot arm
129	Development of remote control system of construction machinery using pneumatic robot arm
130	Analysis of a climbing parallel robot for construction applications
131	A control architecture for robotic excavation in construction
132	Application of ga in optimal robot selection for bridge restoration
133	The study of remotely teleoperated robotic manipulator system for underwater construction
134	Real-time sense-and-act' operation for construction robots
135	Spatial model for path planning of multiple mobile construction robots
136	Balancing human-and-robot integration in building tasks
137	Distance measurement technology development at remotely teleoperated robotic manipulator system for underwater constructions
138	Construction of ceiling adsorbed mobile robots platform utilizing permanent magnet inductive traction method
139	Adapting a teleoperated device for autonomous control using three-dimensional positioning sensors: experiences with the Nist Robocrane
140	Automated construction by contour crafting - related robotics and information technologies
141	A service robot for construction industry
142	Automating inspection and documentation of remote building construction using a robotic camera
143	A heavy climbing robotic platform for geotechnical applications
144	Climbing robots with adaptive grippers for construction
145	A hybrid pole climbing and manipulating robot with minimum DOFs for construction and service applications
146	(Road) robotic systems for pavement lane painting operations
147	Graphical simulation of remote control construction robot based on virtual reality
148	A robotized drilling system for rocky wall consolidation
149	Multiconfigurable inspection robots for low diameter canalizations
150	Application of robots for inspection and restoration of historical sites
151	The analysis of the curtain wall installation robot: based on the test in the construction site
152	Development of a parallel typed robot with a sensorless observer for harbor construction

153	Development of hybrid robot for construction works with pneumatic actuator
154	Example of experimental use of 3D measurement system for construction robot based on component design concept
155	Pose estimation of construction materials using multiple id devices for construction automation
156	Sustainable cooperative robotic technologies for human and robotic outpost infrastructure construction and maintenance
157	A distributed feedback mechanism to regulate wall construction by a robotic swarm
158	Wireless sensor-driven intelligent navigation robots for indoor construction site security and safety
159	Control architecture characteristics for intelligence in autonomous mobile construction robots
160	Closure to "construction robot path-planning for earthwork operations" by sung-keun kim, jeffrey s. Russell, and kyo-jin koo
161	A 3d model based control of an excavator
162	Autonomous robot for pavement construction in challenging environments
163	Research on RBF-PID control for the 6-dof motion base in construction tele-robot system
164	Development of a real-time control system architecture for automated steel construction
165	Development of a remote control system for construction machinery for rescue activities with a pneumatic robot
166	Experiment on teleoperation of underwater backhoe with haptic information
167	A novel distributed telerobotic system for construction machines based on modules synchronization
168	Automation of incineration plant demolition and utilization of information technology
169	Examination of practical utility of remotely controlled robots in disasters
170	Using rescue robots to increase construction site safety
171	Massive rock handling by a breaker - graspless manipulation and object recognition
172	Construction automation based on parts and packets unification
173	A multidegree-of-freedom manipulator for curtain-wall installation
174	The application of the human-robot cooperative system for construction robot manipulating and installing heavy materials
175	The study in using an autonomous robot for pavement inspection
176	Graphical modeling and simulation for design and control of a tele-operated clinker clearing robot
177	A multicriteria approach for the optimal design of 2 DOFparallel robots used in construction applications
178	Modified stereo vision calibration method for construction robot

179	Development of immersive augmented reality interface for construction robotic system
180	Pre-acting manipulator for shock isolation in steel construction
181	Intelligent painting process planner for robotic bridge painting
182	Control schemes for tele-robotic pipe installation
183	Intuitive OCU (operator control unit) of MFR (multipurpose field robot) on construction site
184	Concrete paving productivity improvement using a multi-task autonomous robot
185	A UAV for bridge inspection: visual serving control law with orientation limits
186	Cable-suspended robotic contour crafting system
187	Design of a bolting robot for constructing steel structure
188	Cable-suspended robotic contour crafting system (vol 17, pg 45, 2007)
189	Design of a ceiling glass installation robot
190	Auto inspection system using a mobile robot for detecting concrete cracks in a tunnel
191	Development of the curtain wall installation robot: performance and efficiency tests at a construction site
192	Mfr (multipurpose field robot) for installing construction materials
193	Robotic technologies for the automatic assemble of massive beams in high-rise building
194	Human-robot cooperation control for installing heavy construction materials
195	Construction of welding robot network control system
196	Development of prototype of a unmanned transport robot for transport of construction materials
197	Anti-swinging input shaping control of an automatic construction crane
198	Improved force feedback control method for construction telerobot
199	Construction telerobot system with virtual reality (development of a bilateral construction robot)
200	Development of an automated verticality alignment system for a vibro-lance
201	Task management of robots for the automatic construction
202	Remote control of backhoe at construction site with a pneumatic robot system
203	Power assist devices for installing plaster panels in construction
204	A robotic system for road lane painting

205	A new type of bolting robot for steel-frame structure constructions
206	A comparison of two innovative technologies for safe pipe installation - "pipeman" and the stewart-gough platform-based pipe manipulator
207	Human robot cooperative control and task planning for a glass ceiling installation robot
208	Autonomous drilling robot for landslide monitoring and consolidation
209	Wearable haptic glove using micro hydraulic system for control of construction robot system with VR environment
210	A human-robot cooperative system helps out with glass panels in construction
211	Development of automation system for steel construction based on robotic crane
212	Feasibility verification of brick-laying robot using manipulation trajectory and the laying pattern optimization
213	A laser-technology-based lifting-path tracking system for a robotic tower crane
214	Haptic interaction in tele-operation control system of construction robot based on virtual reality
215	Light-weight 3D ladar system for construction robotic operations
216	Simulation of industrial robots for laser welding of load bearing construction
217	Tele-operation construction robot control system with virtual reality
218	Work state identification using primitive static states - implementation to demolition work in double-front work machines
219	Bridge inspection robot system with machine vision
220	Position error modeling for automated construction manipulators
221	Development of conceptual model of construction factory for automated construction
222	A performance evaluation of a stewart platform based Hume concrete pipe manipulator
223	Chronological development history of x-y table based pavement crack sealers and research findings for practical use in the field
224	Design, construction, and testing of a new class of mobile robots for cave exploration
225	Experimental evaluation of a robotic bolting device in steel beam assembly
226	Basic study of smart robotic construction lift for increasing resource lifting efficiency in high-rise building construction
227	Robotic automation system for steel beam assembly in building construction
228	Virtual reality-based teleoperation construction robot control system with 3d visor device
229	Specific mechanisms for construction mobile robots
230	Labview based control and simulation of a construction robot

231	Research on improved force feedback control method for construction telerobot
232	Development of immersive augmented reality interface system for construction robotic system
233	Bilateral hydraulic servo control system based on force sense for construction robot
234	Research on bilateral hydraulic servo control system of construction robotics
235	Study on master-slave control method using load force and impedance identifiers for tele-operated hydraulic construction robot
236	Climbing and pole line hardware installation robot for construction of distribution lines
237	Self-traveling robotic system for autonomous abrasive blast cleaning in double-hulled structures of ships
238	Implementation of a foldable 3-dof master device to a glass window panel fitting task
239	Mechanism and analysis of a robotic bolting device for steel beam assembly
240	Development of a dual robotic arm system to evaluate intelligent system for advanced construction machinery
241	An improved multipurpose field robot for installing construction materials
242	Robot-aided tunnel inspection and maintenance system
243	Strateg+d171 autonomous robots to inspect pavement distresses
244	A conceptualization for the automation of a lift car operation in high rise building construction
245	Ltl-based decentralized supervisory control of multi-robot tasks modelled as petri nets
246	Concept of a wall building industrial robotic system
247	Development of pressure observer to measure cylinder length of harbor-construction robot
248	Study on a vision sensing system for the parameter estimation of a serial construction robot
249	A plan for lunar outpost construction by using robots
250	Relative accuracy enhancement system based on internal error range estimation for external force measurement in construction manipulator
251	Dimension optimization of an orientation fine-tuning manipulator for segment assembly robots in shield tunneling machines
252	A methodology to quantitatively evaluate the safety of a glazing robot
253	Tele-operation construction robot control system with virtual reality technology
254	Wearable robotic system using hydraulic actuator
255	Field application of a robotic system on cable stays of lincheon bridge for snow removal
256	Development of building-façade maintenance robot with docking station based on vertical climbing mechanism (maintenance)

257	Robot system for removing asbestos sprayed on beams
258	An experimental study of automatic cleaning tool and robot for façade in high-rise buildings
259	Real-time NDE of steel cable using Elasto-magnetic sensors installed in a cable climbing robot
260	Development of robotic-crane based automatic construction system for steel structures of high-rise buildings
261	Building of a sample scenario of a built-in guide type robot for external wall maintenance work of a skyscraper
262	Window contamination detection method for the robotic building maintenance system
263	Development of high accuracy position making system applying mark robot in construction site
264	Robot-aided tunnel inspection and maintenance system by vision and proximity sensor integration
265	Development of double arm working machine for demolition and scrap processing
266	Tunnel boring machine positioning automation in tunnel construction
267	High accuracy position marking system applying mobile robot in construction site
268	Automatic welding robot system for the horizontal position in the shipyard
269	Development of high accuracy position marking system in construction site applying automated mark robot
270	Model analysis and experimental technique on computing accuracy of seam spatial position information based on stereo vision for welding robot
271	Autonomous task control system of construction tele-robot based on stereo vision
272	Autonomous construction of a roofed structure: synthesizing planning and stigmergy on a mobile robot
273	Development of refractory brick construction robot in steel works
274	Research on roi image processing technology of teleoperation construction robot based on trinocular stereo vision
275	Sensor based motion planning and estimation of high-rise building facade maintenance robot
276	Study on 3D laser-scanning-based machine vision system for robotic construction vehicles
277	Force feedback control of tele-operated construction robot based on regression model
278	Application of a position-force control method in a master-slave teleoperation construction robot system
279	Operability of a control method for grasping soft objects in a construction teleoperation robot tested in virtual reality
280	Master-slave control method with force feedback for grasping soft objects using a teleoperation construction robot
281	Human-robot-environment interaction interface for robotic grit-blasting of complex steel bridges
282	Evaluation of construction robot telegrasping force perception using visual, auditory and force feedback integration

283	A robotic system for underwater eco-sustainable wire-cutting
284	Autonomous construction of a roofed structure: synthesizing planning and stigmergy on a mobile robot
285	Heterogeneous multi-configurable chained microrobot for the exploration of small cavities
286	Design and construction of an in-pipe robot for inspection and maintenance
287	High accuracy position marking system applying mobile robot in construction site
288	Open robot control for services in construction
289	An easy handling system for installing heavy glass using human robot cooperation
290	Autonomous robotic dozing for rapid material removal
291	Human-robot integration for pose estimation and semi-autonomous navigation on unstructured construction sites
292	A novel surface segmentation approach for robotic manipulator-based maintenance operation planning
293	Development of fail-safety system for building wall cleaning robot
294	Multi-robot distributed control for construction tasks based on intelligent beacons
295	Autonomous thin spray-on liner application in irregular tunnel and mine roadway surfaces
296	Path planning of wheel loader type robot for scooping and loading operation by genetic algorithm
297	Potentials of robotic fabrication in wood construction: elastically bent timber sheets with robotically fabricated finger joints
298	Design and research of a construction robot based on series parallel structure
299	Geometric and kinematics modeling of tele-operated virtual construction robot
300	An implementation of a teleoperation system for robotic beam assembly in construction
301	Analysis on autonomous task trajectory tracking performance of construction robot with online gravity compensation
302	Job planning and supervisory control for automated earthmoving using 3d graphical tools
303	Development of an automated freeform construction system and its construction materials
304	Optimal machine operation planning for construction by contour crafting
305	Design and construction of a scale robotic excavator work-cell to test automated excavation algorithms
306	Robot-based construction automation: an application to steel beam assembly(Part i)
307	Prototype for glazed panel construction robot
308	Robot-based construction automation: an application to steel beam assembly(part ii)

309	Glazed ceiling panel construction robot
310	Installation of heavy duty glass using an intuitive manipulation device
311	Potential of time-of-flight range imaging for object identification and manipulation in construction
312	Chip-based real-time gesture tracking for construction robot's guidance
313	Modified discrete event simulation algorithm for control of automated construction operations
314	Automating construction operations using discrete event simulation models
315	Robotic tile placement: tools, techniques and feasibility
316	Development of a teleoperation system for a construction robot
317	Automatic detection and verification of pipeline construction features with multi-modal data
318	Development of a BIM-based automated construction system
319	Virtual prototyping for robotic fabrication of rebar cages in manufactured concrete construction
320	Rapid and automated determination of rusted surface areas of a steel bridge for robotic maintenance systems
321	A tree-based algorithm for construction robots
322	Underwater construction robot for rubble leveling on the seabed for port construction
323	Considerations regarding the construction of a minirobot for surveillance and inspection
324	Towards a vision controlled robotic home environment
325	Mobile 3d mapping for surveying earthwork projects using an unmanned aerial vehicle (UAV) system
326	A lightweight bridge inspection system using a dual-cable suspension mechanism
327	Towards on-site autonomous robotic floor tiling of mosaics
328	Introduction of human-robot cooperation technology at construction sites
329	Collision-free 4d trajectory planning in unmanned aerial vehicles for assembly and structure construction
330	Robotic explosive charging in mining and construction applications
331	In-situ fabrication: mobile robotic units on construction sites
332	Modeling and control of automated pipe hoisting in oil and gas well construction
333	Construction site navigation for the autonomous excavator Thor
334	Position reaction force control of teleoperation construction robot for grasping soft objects

335	Automated measurement and estimation of concrete strength by mobile robot with small-sized grinding drill
336	Vision guided autonomous robotic assembly and as-built scanning on unstructured construction sites
337	Intuitive task programming of stud welding robots for ship construction
338	Automatic path-planning algorithm for realistic decorative robotic painting
339	Design and construction of a translational parallel robot for drilling tasks
340	Towards a new BIM 'dimension'-translating BIM data into actual construction using robotics
341	Augmented reality-based tele-robotic system architecture for on-site construction
342	Development of a telerobotics system for construction robot using virtual reality
343	A framework of indicators for assessing construction automation and robotics in the sustainability context
344	A robotic cutting tool for contaminated structure maintenance and decommissioning
345	Design and construction of a robot hand prototype for underwater applications
346	Assistive robotic micro-rooms for independent living
347	A low-cost robotic system for the efficient visual inspection of tunnels
348	Cable robot for non-standard architecture and construction: a dynamic positioning system
349	Between manual and robotic approaches to brick construction in architecture expanding the craft of manual bricklaying with the help of video projection techniques
350	Ceiling work scenario based hardware design and control algorithm of supernumerary robotic limbs
351	Robotic SHM and model-based positioning system for monitoring and construction automation
352	Estimation for torques applied to the master side in a construction robot teleoperation system
353	Research on improving the efficiency and welding quality of welding robot for construction machinery structure
354	Parameter study of chain trenching machines of underwater construction robots via analytical model
355	Robotic 3d-printing for building and construction
356	Machine learning approach to automatic bucket loading
357	Site automation: automated/robotic on-site factories
358	Simulation of automated construction using wire robots
359	Support system for slope shaping based on a teleoperated construction robot
360	Support system for teleoperation of slope shaping by a construction robot

361	A realisation of a construction scale robotic system for 3d printing of complex formwork
362	Smart automation system dedicated to in frastructure and construction
363	Bridge maintenance automation
364	Key challenges in automation of earth-moving machines
365	Design and analysis of climbing robot based on construction surface inspection
366	Prototyping a remotely-controlled machine for concrete surface grinding operations
367	An electro-hydraulic servo controller for construction robot using system-on-chip device
368	Automated construction of masonry buildings using cable- driven parallel robots
369	Study on parts processing of the traditional wooden construction method using articulated robot
370	Local search on trees and a framework for automated construction using multiple identical robots
371	Robotic timber construction - expanding additive fabrication to new dimensions
372	Autonomous construction with compliant building material
373	Automation of modular assembly of structural frames for buildings
374	Applications of supernumerary robotic limbs to construction works: case studies
375	Human-machine interaction for intuitive programming of assembly tasks in construction
376	A cable-driven robot for architectural constructions: a visual-guided approach for motion control and path-planning
377	Automatic interpretation of unordered point cloud data for UAV navigation in construction (navigation)
378	Using local force measurements to guide construction by distributed climbing robots
379	Robotic system for plaster and finishing works on the construction site
380	Development of a remotely controlled semi-underwater heavy carrier robot for unmanned construction works
381	Smcspo based 3d printing simulator control for building construction
382	Development of 3d printing simulator nozzle system using PID control for building construction
383	Automation of robotic concrete printing using feedback control system
384	Classification of building systems for concrete 3d printing
385	Active control for rock grinding works of an underwater construction robot consisting of hydraulic rotary and linear actuators
386	A method based on c-k theory for fast ster development: the case of a drilling robot design

387	Development of the control algorithm for longitudinal motion of underwater construction robot with trenching
388	A stochastic learning approach for construction of brick structures with a ground robot
389	Online learning control of hydraulic excavators based on echo-state networks
390	Beam for the steel fabrication industry robotic systems
391	Model-based development of robotic systems and services in construction robotics
392	Scene understanding for adaptive manipulation in robotized construction work
393	A master-slave control method with gravity compensation for a hydraulic teleoperation construction robot
394	Robotic fabrication of freeform foam structures with quadrilateral and puzzle shaped panels
395	Pyroshield - a hvac fire curtain testing robot
396	Target-focused local workspace modeling for construction automation applications
397	Potential benefits of digital fabrication for complex structures: environmental assessment of a robotically fabricated concrete-wall
398	Development of a wall-climbing platform with modularized wall-cleaning units
399	Autonomous robotic system with tunnel inspection tool positioning
400	Three types of robot builder for the unsupervised construction of mars habitats
401	Robotic mechanical design for brick-laying automation
402	Wall contact by octo-rotor uav with one dof manipulator for bridge inspection
403	Development of a novel post-construction quality assessment robot system
404	Design and construction of an inspection robot for the sewage pipes
405	Autonomous big-scale additive manufacturing using cable-driven robots
406	Ja-wa - a wall construction system using unilateral material application with a mobile robot
407	Industrial robots application in the construction of buildings and structures
408	Towards force-aware robot collectives for on-site construction
409	Construction inspection with unmanned aerial vehicle [bauwerksinspektion mit unbemannten flugsystemen]
410	A novel building post-construction quality assessment robot: design and prototyping
411	Construction techniques used to automatically pass standard box girders through special passenger-line tunnels
412	Bottom-up cognitive analysis of bionic inspection robot for construction site

413	Design of modular re-configurable robotic system for construction and digital fabrication
414	On-site robotic construction assistance for assembly using a-priori knowledge and human-robot collaboration
415	Automated localization of uavs in gps-denied indoor construction environments using fiducial markers
416	Construction equipment collision-free path planning using robotic approach
417	A robotic wearable exoskeleton for construction worker's safety and health
418	Identification of usage scenarios for robotic exoskeletons in the context of the Hong Kong construction industry
419	Mapping and localization module in a mobile robot for insulating building crawl spaces
420	Study on down-cutting ladder trencher of an underwater construction robot for seabed application
421	Slam-driven intelligent autonomous mobile robot navigation for construction applications
422	Building an integrated mobile robotic system for real-time applications in construction
423	Vision-based integrated mobile robotic system for real-time applications in construction
424	Implementation of admittance control on a construction robot using load cells
425	The study on the integrated control system for curtain wall building façade cleaning robot
426	Modular data communication methods for a robotic excavator
427	Large-scale 3d printing by a team of mobile robots
428	Map - a mobile agile printer robot for on-site construction
429	Active control strategy for trenching work of track-based underwater construction robot
430	The autonomous vehicle celina as educational platform on final works in computer science
431	Real-time simulation of construction workers using combined human body and hand tracking for robotic construction worker system
432	Multimodal trip hazard affordance detection on construction sites
433	Stacked hourglass networks for markerless pose estimation of articulated construction robots
434	Industrial robot control with object recognition based on deep learning
435	Automated defect classification in sewer closed circuit television inspections using deep convolutional neural networks
436	Synthesis of the ac and DC drives fault diagnosis method for the cyber-physical systems of building robots
437	A cyber-physical system of diagnosing electric drives of building robots
438	Concept studies of automated construction using cable-driven parallel robots

439	Design of robot based work progress monitoring system for the building construction site
440	BIM plus robot creates a new era of building construction
441	UAV-enabled site-to-BIM automation: aerial robotic- and computer vision-based development of as-built/as-is BIMs and quality control
442	Perspectives on a BIM-integrated software platform for robotic construction through contour crafting
443	Information modeling of an underground laboratory for the r&d of mining automation and tunnel construction robotics
444	Dynamics modeling and structural analysis of underwater construction robot
445	Workpiece modeling for adaptive robotized construction work
446	Adaptive perception and modeling for robotized construction joint filling
447	Enhancing perceived safety in human-robot collaborative construction using immersive virtual environments
448	Teleoperated construction robot using visual support with drones
449	Foam custom single task construction robot
450	A propulsion performance test of underwater construction robot light work ro-v in circulation water channel
451	Improved productivity, efficiency and cost savings following implementation of drone technology in the surveying industry
452	Framework for human performance analysis in unmanned aircraft system (UAS) operations in dynamic construction environment
453	Floor cleaning robot with reconfigurable mechanism
454	Development of a robot for boiler tube inspection
455	Glass facade cleaning robot with passive suction cups and self-locking trapezoidal lead screw drive
456	Automatic inspection of embankment by crawler-type mobile robot
457	Automatic traveling method for the self-propelled tunnel inspection system
458	Localisation of a mobile robot for bridge bearing inspection
459	Tunnel structural inspection and assessment using an autonomous robotic system
460	Cu-brick cable-driven robot for automated construction of complex brick structures: from simulation to hardware realisation
461	Process analysis of cable-driven parallel robots for automated construction
462	Cable-driven parallel robot for curtain wall modules automatic installation
463	On the improvements of a cable-driven parallel robot for achieving additive manufacturing for construction
464	A changeable jig-less welding cell for subassembly of construction machinery

465	Robotic inspection tests of tunnel lining concrete with crack light-section device on variable guide frame
466	Concrete inspection systems using hammering robot imitating sounds of workers
467	Robotic application of foam concrete onto bare wall elements - analysis, concept and robotic experiments
468	Improvement of the mobile robot location dedicated for habitable house construction by 3d printing
469	Feasibility study for drone-based masonry construction of real-scale structures
470	Planetary lego: designing a construction block from a Regolith derived feedstock for in situ robotic manufacturing
471	Automatic multi-image stitching for concrete bridge inspection by combining point and line features
472	Smart construction robot technology to improve construction and safety in outer walls of high-rise buildings
473	Automation of the execution of monolithic reinforced ceilings
474	A semi-autonomous mobile robot for bridge inspection
475	Construction and usage of three-dimensional data for road structures using terrestrial laser scanning and UAV with photo grammetry
476	Framework for automated registration of UAV and UGV point clouds using local features in images
477	Monocular vision-based parameter estimation for mobile robotic painting
478	Implementation of an augmented reality AR workflow for human robot collaboration in timber prefabrication
479	An occupancy grid mapping enhanced visual slam for real-time locating applications in indoor GPS-denied environments
480	Collaborative welding system using BIM for robotic reprogramming and spatial augmented reality
481	Towards mobile projective AR for construction co-robots
482	Construction of the remote welding system based on power line communication
483	Man-machine cooperation of building robot based on interactive force information
484	3d printing for construction based on a complex wall of polymer-foam and concrete
485	Large-scale digital concrete construction – conprint3d concept for on-site, monolithic 3d-printing
486	Measuring and positioning system design of robotic floor-tiling
487	Tip localization analysis for mobile manipulator in construction field
488	Soft additive fabrication processes: material indeterminacy in 3d printing
489	Vision-based obstacle removal system for autonomous ground vehicles using a robotic arm
490	Computer vision for real-time extrusion quality monitoring and control in robotic construction

491	Real-time scene segmentation using a light deep neural network architecture for autonomous robot navigation on construction sites
492	Lnsnet: lightweight navigable space segmentation for autonomous robots on construction sites
493	Vision-based estimation of excavator manipulator pose for automated grading control
494	A vision-based marker-less pose estimation system for articulated construction robots
495	Analytical design of an underwater construction robot on the slope with an up-cutting mode operation of a cutter bar
496	Automated brick pattern generator for robotic assembly using machine learning and images
497	Teaching robots to perform construction tasks via learning from demonstration
498	Semantic relation detection between construction entities to support safe human-robot collaboration in construction
499	Formulation of the optimization problem of the cyber-physical diagnosis system configuration level for construction mobile robots
500	Automatic acquisition of point clouds of construction sites and its application in autonomous interior finishing robot
501	Robotic construction & prototyping of a 3d-printed mars surface habitat
502	An automated system for projection of interior construction layouts
503	Game simulation to support construction automation in modular construction using BIM and robotics technology-stage 1
504	Flexible virtual fixtures for human-excavator cooperative system
505	Youwasps: towards autonomous multi-robot mobile deposition for construction
506	Planning and execution for geometrically adaptive BIM-driven robotized construction processes
507	Autonomous motion planning and task execution in geometrically adaptive robotized construction work
508	Dynamic analysis of high precision construction cable-driven parallel robots
509	Development of an earthmoving machinery autonomous excavator development platform
510	Robotic autonomous systems for earthmoving in military applications
511	Determinants of adoption of robotics in precast concrete production for buildings
512	Trajectory adaptation for an impedance controlled cooperative robot according to an operator's force
513	The analysis of factors influencing on efficiency of applying mobile bricklaying robots and tools for such analysis
514	Dual-arm construction robot with remote-control function
515	Efforts to unmanned construction for post-disaster restoration and reconstruction
516	Control of a hyper-redundant robot for quality inspection in additive manufacturing for construction (inspection)

517	A novel holonomic mobile manipulator robot for construction sites
518	Self-reconfigurable façade-cleaning robot equipped with deep-learning-based crack detection based on convolutional neural networks
519	Four-wheel steering and driving mechanism for a reconfigurable floor cleaning robot
520	Design and modelling of a modular window cleaning robot
521	Parallel 2-dof manipulator for wall-cleaning applications
522	Mobile robot for marking free access floors at construction sites
523	Development of automated mobile marking robot system for free access floor
524	Quicabot: quality inspection and assessment robot
525	Labview based brick laying robot
526	Design, modelling and simulation of novel hexapod-shaped passive damping system for coupling cable robot and end effector in curtain wall module installation application
527	Investigation of robot systems in masonry construction [baubetriebliche untersuchung von robotersystemen im mauerwerksbau]
528	Indoor visualization experiments at building construction site using high safety UAV
529	Automatic brick masonry system and its application in on-site construction
530	Towards automated installation of reinforcement using industrial robots
531	Robotic fabrication of nail laminated timber
532	Adaptive automation strategies for robotic prefabrication of parametrized mass timber building components
533	Construction waste recycling robot for nails and screws: computer vision technology and neural network approach
534	In-situ construction method for lunar habitation: Chinese super mason
535	User interfaces for human-robot interaction in field robotics
536	An autonomous robotic platform for automatic extraction of detailed semantic models of buildings
537	Lidar-equipped UAV path planning considering potential locations of defects for bridge inspection
538	An integrated UGV-UAV system for construction site data collection
539	Construction of slam algorithm for window cleaning robot moving along window frame
540	A scene-adaptive descriptor for visual slam-based locating applications in built environments
541	Cooperative aerial-ground multi-robot system for automated construction tasks
542	Automated defect quantification in concrete bridges using robotics and deep learning

543	Development of construction robots using crazyflie
544	Robotic 3d clay printing of prefabricated non-conventional wall components based on a parametric-integrated design
545	Inspecting manufacturing precision of 3d printed concrete parts based on geometric dimensioning and tolerancing
546	Automation in the construction of a 3d-printed concrete wall with the use of a lintel gripper
547	Bricklaying robot moving algorithms at a construction site
548	Additive manufacturing of cantilever - from masonry to concrete 3d printing
549	Generalized task allocation and route planning for robots with multiple depots in indoor building environments
550	The problem of manipulation and angular orientation of gripping devices of construction robots
551	Optimization of grasping efficiency of a robot used for sorting construction and demolition waste
552	Generic design aided robotically facade pick and place in construction site dataset
553	A general approach for automating teleoperated construction machines
554	Direct-visual-operation support system for unmanned construction
555	Robot construction simulation using deep reinforcement learning+b21b4:b22b6b4:b20b4:b24bb4:b20
556	Measurement for cracks at the bottom of bridges based on tethered creeping unmanned aerial vehicle
557	Proximity prediction of mobile objects to prevent contact-driven accidents in co-robotic construction
558	Augmented drawn construction symbols: a method for ad hoc robotic fabrication
559	Teaching robots to perform quasi-repetitive construction tasks through human demonstration
560	Deep learning of grasping detection for a robot used in sorting construction and demolition waste
561	Vision-based robotic system for on-site construction and demolition waste sorting and recycling
562	Structural stay-in-place formwork for robotic in situ fabrication of non-standard concrete structures: a real scale architectural demonstrator
563	Complete coverage path planning using reinforcement learning for Tetromino based cleaning and maintenance robot
564	What lies beneath: material classification for autonomous excavators using proprioceptive force sensing and machine learning
565	Agent based modeling to optimize workflow of robotic steel and concrete 3d printers
566	Combining the robot operating system with building information modeling for robotic applications in construction logistics
567	BIM-based task-level planning for robotic brick assembly through image-based 3d modeling
568	Bond properties of reinforcing bar penetrations in 3d concrete printing

569	Sampling robot for primary circuit pipelines of decommissioned nuclear facilities
570	A comprehensive performance evaluation of different mobile manipulators used as displaceable 3d printers of building elements for the construction industry
571	Determining a numerical efficiency indicator for a mobile bricklaying robot
572	Life cycle cost analysis of the steel pipe pile head cutting robot
573	Controller area network standard for unmanned ground vehicles hydraulic systems in construction applications
574	Flexible and transportable robotic timber construction platform – TIM
575	Automated manufacturing for timber-based panelised wall systems
576	Development of an automatic sorting robot for construction and demolition waste
577	Construction of land base station for UAV maintenance automation
578	Robotic spray coating of self-sensing metakaolin geopolymer for concrete monitoring
579	Automation of the construction process by using a hinged robot with interchangeable nozzles
580	A Planning System for Robot Construction Tasks
581	Development of a survey and inspection robot system for underwater construction works