Enhanced hybrid Robot Architecture applied a human being nervous system

Dong-Hee Choi*, Hong-Seok Kim**, and Hong-Seong Park*

* Department of Communication Multimedia Engineering, Kangwon National University, Kangwon-do, Korea
(Tel : +82-33-251-6501; E-mail: {blesscdh, hspark}@control.kangwon.ac.kr)
** Manufacturing Information Technology Team, Korea Institute of Industrial Technology, ChonAn, Republic of Korea
(Tel : +82-11-301-5769; E-mail : hskim@kitech.re.kr)

Abstract Robot control system considers various requirements. Firstly, it needs adaptation for unpredictable and dynamic environment. Secondly, it needs way to make do not injurious action to human because live with a person. Thirdly, it needs processing about aim of robots. In this paper proposed that these requirements effective robot control architecture. Robot control architecture can divide Deliberative, Reactive, Hybrid. Recently, robot control architecture that come Deliberative and use hybrid architecture that apply advantage of Reactive architecture is studied much. Hybrid control purpose to combine the real-time response of Reactive with the rationality of Deliberative. Our purpose is enhancement of hybrid architecture that is studied in these days. Proposed architecture that applied human's nervous system can reduce relativity between each module of existent architecture and drive response speed guarantee and safe robot action.

Keywords: Hybrid Architecture, Neural system, Agent, Robot control architecture

1. INTRODUCTION

Personal robot is that lives and helps human with human being same space. Personal robot coexists with a person unlike industrial robot that is cut with a person. Personal robot adapting in human living environment, it takes charge works that ordinary people as well as cleaning and hates. Industrial robot had achieved many works instead of human in industry field along with development of mechatronics technology. Because, robot can be precise and put big power than a person, and is easy to achieve recursive work. But, the extent had been magnified by new technology area that use extent of robot is individual, human coexistence style robot such as public robot and field robot as mayor who do to this production spot ended up in maturity stage already and principal parts necessity of housework labor, social graying and augment of cloth desire, labor power decrease and Dirty, Dangerous, Difficult work and human labor principal parts necessity etc., of danger work are brought steadily. These intelligent robots may act role that have human and close interaction, and help human's activity directly in area of human's life. But, because robot lives along with human, there are many difficulties to act role that help. Robot that work in statically surrounding like industrial robot evaluates Performance of robot with thing which achieves given duty, but problem that personal robot must adapt in dynamic environment change that can not predict happens. This means that interaction that robot does with comprehension about being and human activity field need. Therefore, robot sense human's active area, in reply disposal way with plan, and accomplishes that robot does purpose via procedure that act. Until robot recognizes surrounding and acts to solve these problems, it proposed various robot Architecture for processing.

Proposed architecture s can divide to greatly three classes. First is Reactive architecture that fast response of fixed escaping and so on about environment change such as human's unconditioned reflex action. These Architecture is advantage that can correspond sensitively in environment change, but estimate is impossible the future for robot autonomy.

Second is Deliberative Architecture that recognize environment change such as human's conditioned reflex and corresponds in environment with own knowledge. Because have knowledge base and act with contemplated result so that may be coincided in purpose of robot, robot autonomy is suitable architecture , but controversial point that time from

sense to response is so dragging in situation that robot must process emergency situation happens.

Third is hybrid architecture that connects two architecture using advantage of above two architectures. It is quickly processing for urgency situation acknowledge about architecture of possible Reactive control base and experienced situation processing rule base behavior pattern and studying through Knowledge-base all of architecture of possible Deliberative control base through suitable combination solve. It is recognized with the problem important from like this hybrid control Architecture how to connect Reactive architecture and Deliberative architecture. Also to be how the plan regarding the thing authorization strong point two structures maximizes is researched.

This paper is consisted as following. Section 2 – robot architecture is proposed in existing. Section 3 – justice and characteristic of Agent system. Section 4 – feature of Nervous system. Section 5 – Propose new architecture that apply Agent in robot control architecture, and conclude conclusion in Section 6.

2. ROBOT ARTHCITECTURE

Robot control architecture (Reactive Control Architecture, Deliberative Control Architecture, Hybrid Control Architecture) of can divide by 3 characteristic of each robot control architecture as following

2.1 Deliberation Control Architecture

Deliberation Control Architecture Deliberative control architecture is called in plan base control architecture, and it is consisted intelligence system of Sense-Plan-act. This thing is methodology that come out in traditional Artificial Intelligence that an act dependently about thing which is expressed in the world that robot is active. Deliberative control Sense, Plan, Act a sequentially go.

First step - It gets sensor information. Second step - It reasons whether must achieve some action through comparison with interior knowledge information. Third step - Search for and analyze home suitable reasoning in specification target that robot must choose and compose scenario. Fourth Step - According to plan, it does suitable action in situation.

But, operation expense for reasoning/plan is grown in embedded system like Mobile robot for space search. Because picking up of correct information by noise that happen qualification of information and thread surrounding that get from sensor is difficult, difficulty happens reasoning and result. Robot of architecture is suitable in silence environment, but applications in many place of element are difficult variableness enemy like dynamic surrounding such as personal robot.

2.2 Reactive Control Architecture

Ungues World model, and is control architecture that use sensor information ten thousand. Sensor and Actuator have profession linked architecture. It can get fast response result reflecting result by situation condition that is not decision by complicated reasoning. Therefore, system of this architecture flips fast in environment that is variable and is not architecture d. But, deduction about the future is impossible because did not consideration about data processing and so on about present state except. Because purpose and robot about action do not consider sphere of procedure that action is possible, control is difficult, and because it is no ability for learning, achievement softness is lacking. Is architecture that mix advantage of above two architecture s to overcome limitation of Deliberative Control course Reactive control two architectures. Purpose of this architecture is deliberation system rationality and combination of real time response of reactive system. Two components achieve each other separatively, but Reactive component can ignore and run Deliberative component in environment that fast response is required. Robot with these result if result about optimization action appears efficiently reaction rule of Reactive component when produce upside situation as update box result of little more reasonable action get can. Hybrid control architecture with Figure.1 3-layer architecture, Reactive component, deliberative component, intermediate component are composed. Reactive component provides fast rejoinder in dynamic environment. Achievement of work that Deliberative component is complicated Intermediary component for offer two components relationship scheduling need.
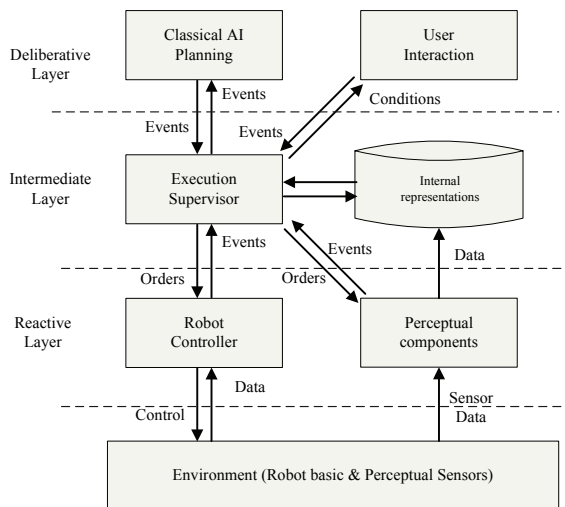
2.3 Hybrid Control Architecture

Fig. 1 3-Layer Robot Control Architecture.

Agent has active carriage that do not achieve work that is

given passively by self-regulating process (Autonomous Process) that achieve work instead of user about specification purpose, and seek the purpose achievement with own purpose. Agent is part of some environment without existing independently or it acts in. Environment is OS, network here, or user, resources call game environment etc.. and agent has knowledge base and reasoning function, or it plans information interchange with other agent and problem solving through communication.
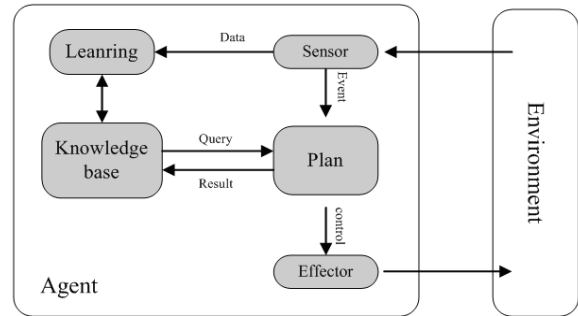
3. AGENT ARCHITECTURE

Fig. 2 Agent Architecture

Figure 2 is that agent schematizes thing for outside environment and how to do interaction. Agent runs Cognition, feedback, studying about outside environment forefinger. Therefore, agent has following characteristics and should be achieved.

Agent has active carriage that do not achieve work that is given passively by self-regulating process (Autonomous Process) that achieve work instead of user about specification purpose, and seek the purpose achievement with own purpose. Agent is part of some environment without existing independently or it acts in. Environment is OS, network here, or user, resources (resource) call game environment etc.. and agent has knowledge base and reasoning function, or it plans information interchange with other agent and problem solving through communication. Figure 2 is that agent schematizes thing for outside environment and how to do interaction. Agent runs Cognition, feedback, studying about outside environment forefinger. Therefore, agent has following characteristics and should be achieved.

A. autonomy
Agent must be able to solve their problem without direct interference of a person or other agent, agent's activity and their own internal state some measure control possible.

B. intelligence
Agent achieves purpose that seeks in Agent environment that come Knowledge-base that increase and is given with Inference Rule. Intelligence has autonomy and affinity effectively and agent can expect better effect through plan and experience work that is same with intelligence

C. sociality
It means communication ability between agents. That is, it depends on Message Switching between agent when need other agent's help for achievement of work that do not process to one agent. Communication between agent that use agent communication language(ACL) achieves can use message passing or share memory method and blow other agent's method.

4. NERVOUS SYSTEM

Information that accept from outside transmits spinal through sensory nervous. In hand information on brain body at the same time transmission role that transmits information to control relevant muscle so that flip by motor nerve do. Brain takes charge function that analyzes and foretells information that is received from hand, and communicates judgment result to nerve fiber through hand
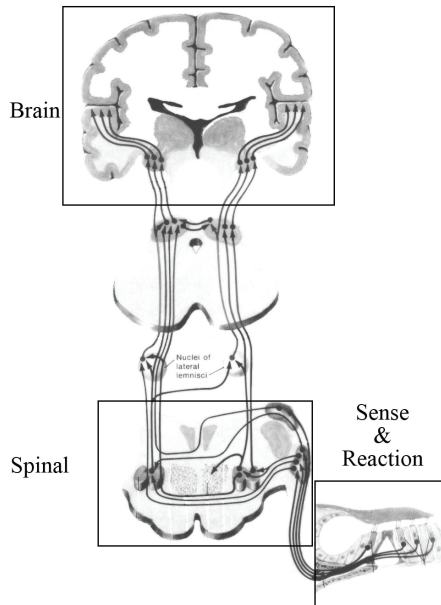

Figure 3. Neural System

Human is reaction which occur consciously according to instruction by cerebral estimation about outside environment forefinger, and there is reaction which occur unconsciously independently of consciousness, this is known as reflection.

Reflection does as can decrease time that take flowing cerebrum reacting when we faced in danger without flowing cerebrum and overcome crisis because react quick. if you avoid the ball that see toward head, too late already.
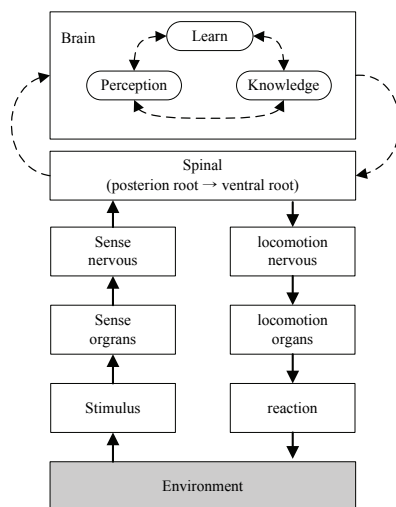

Figure 4 Stimulus delivery paths

Reflexion shows first by action before cerebrum feel, judge. It recognizes being passed in cerebrum later. These reflection centers are after brain and hand. Because stimulation is given, Stimulation path of communication until reflexion occurs is same with figure 4. Is same with robot architecture figure 5 that wish to propose in this paper.

5. PROPOSED ROBOT ARCHITECTURE

Robot that wish to propose in proposed robot architecture this paper architecture similarly with process to reaction from information that human is recognized from outside. It composed in 3-Layer Architecture of existent hybrid architecture to divide and process similar function.

Proposed architecture differentiated function of internal module of existent hybrid architecture and take away module liver synergistic relation of hybrid architecture through change of control method and do robot control through negotiation and information interchange between modules in independent relation mutually using Agent.
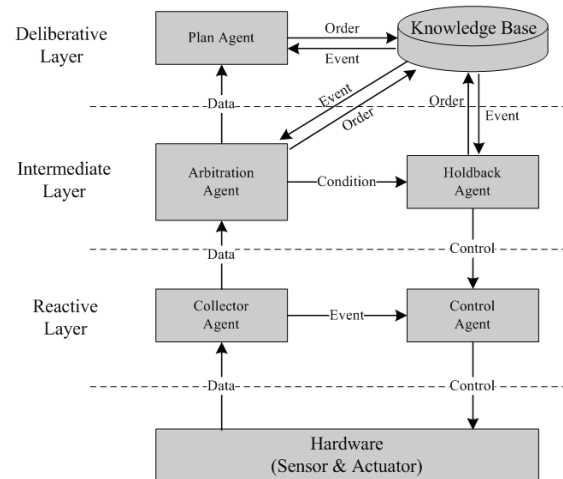

Figure 5. Enhanced Hybrid Control Architecture

Each class and each Agent can explain as following.
1. Reactive Layer

It acts being linked directly in Reactive class outside environment. Because this layer comes Collector Agent, there is Control Agent. Collector Agent gathers environmental information that is received through sensor (video, voice, supersonic waves, IR etc.) and it takes charge function that information transmits Arbitration Agent and environment event by Control Agent. This time, collected data have precedence and transmit to other agent. Control Agent takes charge Actuator self-discipline about event that Control Agent is received from Collector Agent from Holdback Agent's control lower part.
2. Deliberative Layer

It composes scenario about target achievement of robot with information that is received from Deliberative layer outside environment. This layer composed Plan Agent and Knowledge Base. Plan Agent progresses studying for robot scenario and outside environment using techniques etc… of traditional AI reasoning, Fuzzy, Neural Network etc. Knowledge Base is storing place about environment disposal rule which store fundamental rule about robot action that user (a person) wants, and is studied by Plan Agent. This module offers rule about

robot action and studied information to agents of Intermediate class.

3. Intermediate Layer

It takes charge arbitrator function take charge arbitrator function existing between two-layer described in front of Intermediate layer. This layer is composed Arbitration Agent and Holdback Agent. Arbitration Agent decides if is going to send data that is decided by Knowledge base relationship rule by Plan Agent. And, it transmits robot state information in Holdback Agent.

6. CONCLUSION

We proposed improved hybrid control architecture that use Agent for fast and effective reaction human and interaction of robot in this treatise. Module function of existent hybrid architecture is composed mutually dependently, and specially, Robot Controller module outside environmental information collection, data sorting because must take charge data for Reactive Control and data for Deliberative control, Execution Supervisor communication, Actuator Control to offer gains of quick environment reaction hard. Because work processing ratio of architecture   that is proposed in this treatise is fast, and have dual control structure that use Control Agent and Holdback Agent because each Agent takes charge minimum function, robot can be active about environment rapidly and safety

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