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Designing Construction Skill Tree Implemented Cognitive Architecture [CSIA] For the Comparison with Thinking Layer Agent Agricultural Riped Fruit Plucking

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Abstract
There is an excellent demand aimed toward mechanization within the field of agriculture. the development of Robotics technology is daily exponential this research paper primary concentrates in fruit-plucking robots. Employing smart robotic machine learning to form the robot adapt itself in non-deterministic environment, which may add the fields, with or without farmer. This paper is related to aimed toward to urge the solutions and algorithms for computers to match human and non-human like behaviours, the power to think, almost like peoples and animals within the lifestyle. This Comprises, testing cognitive principles of mind on robots. Performance evaluation of Industry or agriculture-based robots in real time environment are often compared against human performance. Building robots using control architectures supported science, understanding the need of a farmers within the agriculture land, and implementing the intelligence device in order that , machine can work as per the need of a farmer for instance, land ploughing work, Fruit plucking etc.

Keywords: Cognitive architecture, CST [Constructing Skill Trees], Sensorimotor Skills

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Introduction

As we are Indians our chief livelihood is agriculture. We are growing economically strong day to day, one among the explanations for it's agriculture. this is often the sector our economy is predicated on. In youth of our civilization, we weren't that strong in agriculture, it remained under developed. India had to shop for food grains from other countries. Now once we consider agriculture India is one of the strong countries in cultivation and that we produce food-grains quite what's required.

Improvements in agriculture were seen with the assistance of our five-year plans. India is now sufficient in agriculture. [1] Agriculture is extremely much required for mankind. It's about the farming of animals, plants and fungi for food and other products. Once we consider agriculture the primary thing that involves our minds is cultivation i.e. cultivating food materials like wheat, cereals, fruits, vegetables etc. Importance of agriculture is follows: Basis of Livelihoods Agriculture is that the foremost basis of occupation for several people. Many people have considered agriculture as a mean of living and about 70% of them are directly linked with agriculture. But people in advanced countries won't take up agriculture. Contribution to National revenue for developing countries like India agriculture is that the basis of revenue. However, once we consider developing countries bit of revenue we'll be contributed from agriculture. Stock of Food also as Fodder Fodder for livestock is obtained from agriculture sector. Milk given by cow to people may be a sort of caring food. Livestock also meets people's food needs of individuals is met by livestock. Importance to the International Trade The item for exports in our country are sugar, tea, rice, spices, tobacco, coffee etc. which depends on agriculture. Imports are often reduced if we've proper and smooth development practice in agriculture, which ends up in increase in exports. With the assistance of this the unfavourable balance of payments and convertible exchange is reduced. This savings and money obtained helps us to import essential inputs, raw materials

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and machinery. Marketable Surplus because the nation develops many of us involve in manufacturing, mining also as other non- agricultural field. of these persons depend upon food production that they could meet from the nation's marketable surplus. the assembly increases thanks to the event that takes place in agriculture sector which intern leads to expansion of marketable surplus. Source of staple Raw materials are required for any quite industries. Industries like cotton, sugar, jute fabric, edible and non-edible oil, tobacco etc obtain their raw materials from agriculture. , Many other industries like rice husking, processing vegetables and fruits obtain the staple from agriculture. Significance in Transport the produce obtained from agriculture has got to move from cultivation land to the market after the harvesting is completed that transport is required in greater extent. This helps in exchanging produced food-grains in market at right time when demand is met and to urge benefited from it which ends up in profit farmers. To a bigger extent the revenue of state depends within the growth of agricultural sector. exchange Resources Agriculture plays vital role in obtaining exchange by exporting agricultural produce like cotton, jute coffee, oilseeds, and spices to other countries. The exchange of commodities contributes about 18 you look after the entire value of exports of our nation. This shows that agricultural crops may be a vital source of income. Great Employment Opportunities As we all know that population of India is increasing invariably ,the important thing that's required for people to hold their livelihood is employment .Agriculture provides employment to several people regardless of whether or not they are educated or uneducated ,which includes works like construction of irrigation ,planning of drainage systems ,building sheds etc. this manner people are becoming employed in agriculture which increase the event of country. Economic Development Agriculture employs many of us by this we see decrease the unemployment slowly and helps in contributing to economic development. Which has improved value level and even people's normal of living. the expansion in country has led to focus more on agriculture. The economic process rate

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relies on the agriculture. Source of Saving Source of saving is extremely important, this is often increased thanks to the event in agriculture. After revolution many rich farmers started savings. In future, the agriculture sector are often developed further with the assistance of surplus quantity being invested in agriculture. Food Security the main difficult faced by the emerging countries is starvation, which may be prevented by food security, Food security is ensured by a stable agricultural sector. this is often one among the important requirements of any country.

The source of income for several countries believes agricultural products and its related industries. We adopt different techniques for cultivating different sorts of food materials. The procedure for cultivating fruits could also be different from vegetables. Proper procedure has got to be administered permanently yield.

Agriculture is extremely important in country like India. Agriculture has become the core occupation in many countries like India. Agriculture is one main source for Indian economy.

Prevailing System

The fruit-plucking robots have few drawbacks. One such drawback is driverless engineers for agriculture is its accountability. Robots are successful change the culture of agriculture. Energy issues is proven to be expensive. Few shortcomings of fruit-plucking robots are:

Fruits is protected by leaves and branches.

The robots have plucked the riped fruits without destroying the branches and leaves. Individual are able apply their conceptual expertise. More consideration is given to the details of the shape of the fruit, color of the fruit. But the robots have to use their image processing technique to identify riped fruits. So the use air jet is used to blow out the leaves and then to pluck the riped fruits.

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Force applied to the fruits will destroy the fruits

The force applied on fruits while plucking the fruit will destroy them making the fruits no longer eatable. People will make use of their critical thinking skills. They observe, interpret, analyze, infer and evaluate their decisions. [3] According to their decision they will apply the required pressure and pick the fruits.[2] This results in picking the fruits without damaging. The robotic arm is made of rubber to lessen the harm occurred while picking the fruit.

The fruit-plucking robots are not able discriminate ripe and unripe fruit

People are cable of using their decision-making skills, knowledge of concepts that they have already learnt and decide whether a fruit is ripe or not. They compare the results of the previously plucked fruits and hence they will correctly select the ripened and unripe fruits. The robots will rely on their image processing techniques. A camera will be placed on the top. It captures the size, color, weight, shape of the fruit. This image of the fruit is compared with previous images of the fruits and is classified accordingly as ripe or unripe fruit. But this image processing might fail in unfavorable conditions. The fruit might look ripe when compared with its color, but actually the fruit is unripe. In such cases the robot will misinterpret this result and classify it as ripe fruit and plucks it.

They cannot discriminate between the color of the leaves and color of unripe fruits

Humans will have knowledge about the problem-solving skills. They examine and then discriminate between the fruit and other parts of the tree. The robot again has completely depended on its image processing capability to identify the shape and density of the fruit. This will be compared with its previously captured images. Then it comes to a conclusion which may be correct or incorrect.

They pluck the fruits by destroying leaves and branches

Humans think logically. They work creatively in order to pluck fruits without destroying leaves, branches and other parts of the tree. In robots, the robotic arm is made of rubber. This

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will lessen the damage but will fail to prevent the damage from occurring. All the above-mentioned scenarios are some of the shortcomings of existing fruit-plucking robots. We are focusing on the shortcoming that the inability to discriminate between ripened and unripe fruits during fruit-plucking. An agricultural robot will be equipped with intelligence so as to be able to robustly operate in the unstructured, dynamic and hostile agricultural environment. The proposed solution is to develop a cognitive architecture [1] where the agents exhibit different levels of thinking. The prime focus is acquisition of sensorimotor skills. The robots have to discover their own body and acquisition of associated cognitive skills such as self and non-self-distinction.

Projected Architecture

CST Architecture is implemented as 5-layered architecture.[6] The projected architecture has 5 layers as shown in the Figure 3.1The layers of this architecture define incremental control systems for robots that show different levels of thinking. The five layers are reflexive, reactive, deliberative (including all BDI MODELS), thinking and meta-thinking. The three columns are Perception, Intention, and Reasoning.

Figure 3.1: CSIA Architecture

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Reactive Layer

The second layer is reactive layer. The agent has to sense all the parameters within its environment and exhibits its reaction. Here, there is a single agent within the environment and that will be three parameters. The conditions within the environment are rotten fruit, unriped fruit and riped fruit. These parameters are square in shape and they are differentiated based on their colours. The rotten fruit is of red colour. The unripe fruit is green in colour and the ripened fruit is yellow in colour. The agent starts executing the 'navigate' behaviour and moves across the environment. Whenever the agent hits a parameter, its reaction has to be recorded. In simulation, we have related the reaction as the energy metric. We have co-related the reaction and energy metric. The changes in the agent's reaction is displayed by the size of the agent. The size of the agent after sensing the parameters reflects the type of the fruit sensed. The agent moves using 'wander' and 'avoid' behaviours, if it encounters a 'fruit 'parameter, it executes 'react' behaviour. 'React' behaviour of the robot is shown in the form of 'energy 'which is just a parameter returned by image processing sub-system based on the quality of fruit identified. These reactions are the voluntary behaviours of the humans. Also termed as responding to the stimulus. The agents will sense the different kinds of fruits and react accordingly based on colour. If an agent senses the rotten fruit, its energy decreases by 'n' units. When the agent senses the unripe fruit, the energy increases by 'n' units. When the agent senses the 'ripe' fruit, the energy increases by '2n' units. Thus, the agent exhibits different reactions when it encounters different fruits.

Deliberative Layer

The third layer is deliberative layer. The agent in this layer is clever to make decisions. The main goal of a deliberative agent is to pick optimal collection of fruits. The deliberative agent also has a sub-goal. The sub-goal is to not to carry out any action that decreases the energy metric of deliberative agent. [3].The deliberative agent considers its 'internal state'. The 'internal state' denotes to the knowledge the deliberative agent had inherited from reflexive layer and reactive layer. The

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knowledge the agent has gained is that, the deliberative agent should not move towards rotten fruit, as that particular fruit had decreased the energy metric of agent in previous layers. The deliberative agent has also registered the reaction, when it had collected ripened fruit and unriped fruit. The deliberative agent starts executing the 'wander' behaviour. When it comes across the rotten fruit, which is identified by the image-sensing sub-system, the deliberative agent executes the 'avoid' behaviour. The deliberative agent moves away from the rotten fruit and thus prevents the deliberative agent from losing its energy. Preventing the agent from moving towards the rotten fruit, increases the capacity of deliberative agent to collect more number of fruits, which does not decrease the energy metrics of an agent

Thinking Layer

The fourth layer of CSIA is the thinking layer. The agent in this layer is accomplished of thinking. The main goal of a thinking agent is to pick optimal collection of fruits. The thinking agent has two sub-goals. One of the sub-goal is to not to carry out any action that decreases the energy metric of thinking agent. And another sub-goal is to always carry out an action that increases the energy metric of thinking agent more. The thinking agent learns from the previous layers and performs actions. The thinking agent considers the future conditions also. The thinking agent avoids the collection of rotten fruit, and it also avoids the collection of unriped fruits. The thinking agent always moves towards the ripened fruit, so that the energy is increased more. In real time implementation, it is always efficient to pick the exactly ripened fruits from the fruit picking robots. The farmers should be benefitted more by the fruit picking robots. The robots, if they pick the ripened fruits, it is easy for the farmers to sell those fruits immediately before it gets rotten. And the fruit picking robots avoid picking the unripened fruits. This also help the farmers. The unriped fruits are given more time, so that it gets properly ripened and then those fruits are plucked by the robots. The thinking agent starts executing the 'wander' behaviour, once it encounters the obstacle, it executes 'avoid' behaviour. If the thinking agent comes across rotten fruit, it executes 'avoid' behaviour, as the thinking agent had learned from the reactive layer. When the

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thinking agent encounters the unriped fruit, the thinking agent executes 'avoid' behaviour again to satisfy the second sub-goal of the agent at the thinking layer.

Meta-Thinking Layer

The last layer in CSIA is the Meta thinking layer. Meta thinking refers to thinking on thinking. The agent does the evaluation of its own cognitive process. The communiqué between the agents is also shown in this meta-thinking layer. We have also brought [7] CST concept in Meta thinking layer. The agent in this met thinking layer considers the abnormal conditions as well. The fruit picking area may not be in the same condition always. So, we have considered certain conditions and termed them as abnormal conditions. The Meta-Thinking agent should be capable of handling the abnormal conditions as well. The time clock in a tested simulation is predefined. Based on the timer given clock speed the agent moves

Soil Classification

Based on the soil pH values, the following types of soil reactions is done by prolog software based on pH values and other properties that are given in the below Table 4.1 Suitable Crop/Fruits that can be cultivated based on soil pH values

Table 1 Soil Classification based on pH Ranges and Favorable Fruits/Crops for Cultivation

S. No	Soil Colour	Acidity	pH Value Range	Soil type	Suitable Fruits/Crops for Cultivation
1	White	Extremely Acid	0.0-4.5	Marshy soil	Not suitable for cultivation
2	Blue	Very strong acid	4.6-5.0	Laterite soil	Jack Fruit
3	Light Blue	Strong acid	5.1-5.5	Mountain soil	orange
4	Sky Blue	Medium acid	5.6-6.0	Lateral soil	Pineapple, Pyruscommunis, Plum
5	Grey	Slightly	6.1-6.5	Forest	Bromeliaceous,

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		acid		soil	Apple, Malus Sylvestris, Pear
6	Red	Neutral	6.6-7.3	Red soil	Banganpalli Kalepad, Bromeliaceous
7	Black	Mild Alkaline	7.4-7.8	Black soil	Neelam, Mallika, orange
8	Dark slate	Moderate Alkaline	7.9-8.4	Arid soil	Grapes, Pineapple
9	Magenta	Strongly Alkaline	8.5-9.0	Saline soil	None
10	Brown	Very Strongly Alkaline	9.1-14.0	Alkaline soil	Not suitable for cultivation

If the pH value is 0.0 To 4.5 it is Marshy Soil this is soil not suitable for any crop or fruit for cultivation as the soil contains more acidity. The soil as we Tested pH value in the Prolog software by giving the range of pH values from less than 4.5 the Prolog software predicts the result as Marshy Soil.

If the pH value is 4.6 To 5.0 it is Laterite Soil this is soil is suitable for some crops as the soil contains very strong acid the soil is tested by giving pH value in the Prolog software by giving the range of pH values above 4.6 and less than 5.0 the Prolog predicts as Laterite Soil. If the pH value is 5.1 To 5.5 it is Mountain soil this is soil is suitable for some crops as the soil contains strong acid this soil is tested by giving pH value in the Prolog software by giving the range of pH values above 5.1 and less than 5.5 the Prolog is answering as Mountain Soil. If the pH value is 5.6 To 6.0 it is Lateral Soil this is soil is suitable for some crops as the soil contains medium acid.

This soil is tested by giving pH value in the Prolog software. By giving the range of pH values above 5.6 and less than 6.0 the Prolog software predicts as Lateral Soil. If the pH value is 6.1 To 6.5 it is Forest Soil this is soil is suitable for some crops as the soil contains slightly acid this soil is tested by giving the pH value in the Prolog software by giving the range of pH values above 6.1 and less than 6.5 the Prolog is predicting as Forest Soil. If the pH value is 6.6 To 7.3 it is Red Soil this is soil is suitable for some mango fruits as the soil contains Neutral this

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soil is tested by giving the pH value in the Prolog software by giving the range of pH values above 6.6 and less than 7.3 the Prolog Software as Red Soil. If the pH value is 7.4 To 7.8 it is Black Soil this is soil is suitable for some crops as the soil contains mild alkaline this soil is tested by giving the pH value in the Prolog software by giving the range of pH values above 7.4 and less than 7.8 the Prolog predicts as Black Soil. If the pH value is 7.9 To 8.4 it is Arid Soil this is soil is suitable for some crops as the soil contains slightly acid this soil is tested by giving the pH value in the Prolog software by giving the range of pH values above 7.9 and less than 8.4 the Prolog predicts as Arid Soil. If the pH value is 8.5 To 9.0 it is saline Soil this is soil is suitable for some crops as the soil contains strongly alkaline this soil is tested by giving the pH value in the Prolog software by giving the range of pH values above 8,5 and less than 9.0 the Prolog predicts as Saline Soil If the pH value is 9.1 To 14.0 it is Alkaline Soil this is soil is not suitable for crops as the soil contains very strongly alkaline acid this soil is tested by giving the pH value in the Prolog software by giving the range of pH values above 9.1 and less than 14.0 the Prolog predicts as Alkaline Soil.

Remote Controlled Power Tiller

Power tiller is a farm machine which is used for ploughing the field. Draw back with the technology is someone has to walk behind continuously with the machine controlling its direction 8 hours/day on an average.

This results a lot of strain, since one has walk under hot sun, rain and all elemental condition. Further there is safety issue of people get injured by getting in contact with the blades and some case even death. Using remote controlled system for power tiller farmers can now peacefully stand away from the field and operate the power tiller using a hand-held remote-control unit. Remote controlled system for power tiller is kit that can be fitted on an existing power.

Working of Remote Controlled –Powertiller

It consists of three components:

A. Controller unit mounted on power tiller shown in figure 5..1

B. Handheld remote control unit shown in figure 5.2

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C. Compact air compressor for powering pneumatics coupled to engine.

Fig 5.1 Power Tiller

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Fig 5.2 Handheld remote control unit

Fig 5.3 Control unit

The Operator in figure 5.2 has three controls: 1. Left direction control 2. Right direction control 3. Brake lever control for stopping the power tiller. Remote Controlled-Power Tiller kit will be retrofitted in any of the existing power tiller, easy to install Likewise, Fig 5.3 it will be supplementary to new power tillers rolling out of factory Easy to operate, and practically it has nil maintenance.

Working

This is will be simple type remote control uses Radio Frequency communication without microcontroller. In this investigate work power tiller a remote has been designed for several home appliances like television, fan, lights, etc. It gives lot of comfort to the user since it can operate it by staying at one place. We can regulate any of the appliances by using this remote within the range of 400 foots. In the research work comprises of two

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units, transmitter (remote) and receiver section. Whenever we are pressing any key in the remote it generates the equivalent Radio Frequency signals, and these signals are received by the receiver unit. ASK transmitter and receiver is castoff as source and receiver. HT12E, HT12D encoders and decoders are castoff in this electronic circuit.

Remote Section

In remote unit comprises of an encoder (HT 12E) and a ASK transmitter. The encoder produces 8-bit address and 4bit data. Operative will set the address by using the DIP switch connected in A0 to A7 (pin 1 to 8) encoder. If we set an address in the remote section, the equal address will be required in the receiver section. So always set equal address in source and receiver. Whenever we press any key in the remote the encoder produces corresponding 4bit data and send this data with 8bit address by using ASK transmitter. The transmitting frequency is 433MHz. The source output is up to 8mW at 433.92MHz with a range of approximately 400 foot (open area) outdoors. Indoors, the range is approximately 200 foot.

Receiver Section

At the receiver section ASK receiver is present. The receiver also runs at 433.92MHz, and features a sensitivity of 3uV. The ASK receiver runs from 4.5 to 5.5 volts-DC, and has both linear and digital outputs. It receives the data from the transmitter. Then the decoder (HT 12D) decodes the info and it'll enable the corresponding output pin (pin 10, 11, 12, 13). Each output pins are linked to separate flip flops. The output of encoder will variation the state of the flip flop. So its output goes to line (high) from reset (low) state. this alteration makes a high signal within the output of the flip flop. This output isn't capable to drive a relay directly. So, we are using current driver, SL100 transistor act because the current driver. The appliance is connected to 230V AC through the relay and therefore the appliance will start. The relay are going to be re-energized when an equivalent switch is pressed within the remote. this is often because we are pressing an equivalent switch within the remote. The output of the decoder once more goes to high so this signal will again variation the state of the flip

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flop. So, the relay gets re-energized and therefore the appliance goes to OFF state.

Results

In this layer, if the agent comes across an abnormal shaped fruit, it will not be sure of whether to pluck or not to pluck is shown below Fig 6.1. In such case, the agent stores the information about the riped fruit. This will be communicated to the other agents. When the second agent enters the field, it will learn that it should not collect that abnormal shaped fruit

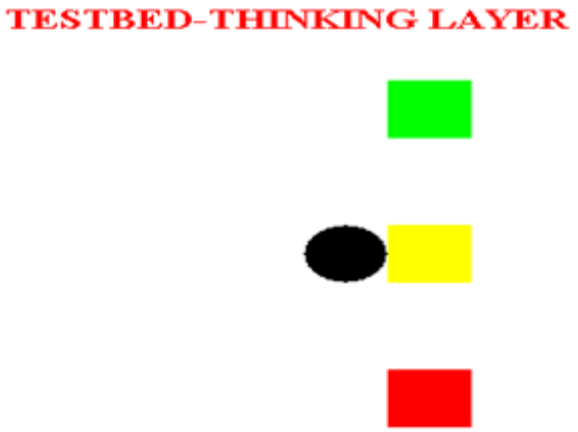

Fig 6.1 Snapshot of Thinking Layer Energy Comparison

Conclusion

While usage of Construction skill tree at the thinking layer, the agricultural fruit plucking robots are cable of to using the skills learned in some problem to solve a new problem quickly. This helps in faster skill acquisitions which helps the robots to discriminate riped and unriped fruits by construction skill tree

Future Enhancement

The CSIA architecture can be extended by adding perceptual behaviour. This can be used in the application areas such as Military, Construction Field, Education, and Medical Application.

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This is can be experimented with CST (Construction Skill Tree) learning Algorithm.CSIA can be made by adding Expert system

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