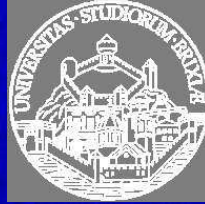


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Behaviours

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Fonti

- Sono presenti numerosi documenti nella pagina del corso di robotica.

Behavioural Control

- Behavioural actions are implemented in Aria.
- The smaller unit of behaviour is called an **action**.
- Behavioural actions can the same types of control values as direct actions: traslation velocity and position, and rotational velocity and heading. But, since the outputs are meant to be combined, it is important that the current set of executing actions use the **same** control on each of the channels.
- Konolige recommends using translational velocity and rotational heading as the standard action outputs for most uses.



The Action Evaluation Cycle

- The set of currently active actions is held on a list in the robot object **SfROBOT**.
- On every cycle (100ms), each action object is evaluated to produce a translational and rotational output, along with a strength for each.
- The strength, which varie from 0 to 1, indicates how strongly the action prefers to have this motion executed.
- The output values for behavioural actions are described by a structure, **ArActionDesired**.
- There are many possible types of resolution strategies: averaging, winner-take-all, competition, etc.

The Behavioural Action SfMovitAction

- Now we'll examine a behavioural action in detail.
- The purpose of this action is to turn the robot to a given heading, and move it forward a given distance.

```
class SfMovitAction : public ArAction
{
public:
    SFEXPORT SfMovitAction(int distance, int heading); // constructor
    virtual ~SfMovitAction() {}; // nothing doing
    // this defines the action
    virtual ArActionDesired *fire(ArActionDesired currentDesired);
    // if we need to reset distance to go
    SFEXPORT void reset() { gone = 0; ax = SfROBOT->getX();
                          ay = SfROBOT->getY(); }

    // interface to Colbert
    static SfMovitAction *invoke(int distance, int heading);

protected:
    ArActionDesired myDesired; // what the action wants to do
    int myDistance, myHeading; // parameters to the action
    int gone; // how far we've gone
    double ax, ay; // old robot position
};
```



The Action Constructor

```
SFEXPORT
SfMovitAction::SfMovitAction(char *name, bool instance)
    : ArAction("Movit")
{
    myDistance = distance;
    myHeading = heading;
    reset();
};
```

- Note the constructor chaining performed by calling ***ArAction("Movit")*** in the prolog of the constructor.

The Action Body (1)

- The action body is defined by the **fire()** function.
- This function is called on every cycle that the action is active, and is responsible for determining the output of the action.
- Remember that this action is supposed to move the robot forward by its first argument, and turn it to the heading given by its second argument.

```
SFEXPORT ArActionDesired *
SfMovitAction::fire(ArActionDesired d)
{
    // reset the actionDesired (must be done)
    myDesired.reset();

    // check the distance to be traveled
    double dx = ax - SfROBOT->getX();
    double dy = ay - SfROBOT->getY();
    ax = SfROBOT->getX();           // set new values
    ay = SfROBOT->getY();
    int ds = (int)sqrt(dx*dx + dy*dy);
    gone += (int)ds;
    sfMessage("Running Movit, gone %d", gone);

    if (gone >= myDistance)
    {
        sfMessage("Finished Movit");
        deactivate();           // turn off when done
        return NULL;
    }
    else
    {
        myDesired.setHeading(myHeading); // control the heading
        myDesired.setVel(200); // moderate speed
    }
    return &myDesired;           // return the desired controls
}
```



The Action Body (2)

- Once the desired distance has been traveled, the action deactivates itself.
- Deactivation has two effects: first, it frees up the action executive from having to process the **fire()** function any more; second, it communicates to Saphira and Colbert that the action has completed.
- If there are other activities that are waiting for the action to complete, they can then proceed.
- If an action does not want to control the movement of the robot, it can return a NULL pointer instead of the **ArActionDesired** pointer; this is done when the action finishes.

Interfacing the Action to Saphira/Colbert (1)

- There are two parts to creating the Saphira and Colbert interface to an action. First, the ***invoke()*** function must be define statically, and serves as a function that can be called from Colbert, just as other functions made available with ***sfAddEvalFn***.
- ***Invoke()*** takes arguments that are Colbert types (int, floats, and void * types), and return an instance of the action.

```
SfMovitAction *  
SfMovitAction::invoke(int distance, int heading)  
{  
    return new SfMovitAction(distance, heading);  
}
```



Interfacing the Action to Saphira/Colbert (2)

- In the file defining the action, we can add code to be executed when the file is loaded into Saphira, using then function ***sfLoadInit***.
- Here is how it's done for ***AfMovitAction***:

```
SFEXPORT void // define interface to Colbert here  
sfLoadInit ()  
{  
    sfAddEvalAction("Movit", (void *)SfMovitAction::invoke, 2, sfINT, sfINT);  
}
```


Invoking the Action (1)

- Once the action is defined and added to Saphira and Colbert, it can be invoked from Colbert using the **start** command, just like a Colbert activity.
- To start up the action, just use

```
start Movit(1000,95);
```

which will start up the action with a distance argument of 1000 and a heading argument of 95.

- An example of invoking the **Movit** action from Colbert is given in the **tutor/movit/init.act** file, as the activity **movit_act**.

```
act movit_act(int dist)
{
    start Movit(dist, 90) priority 10;
    remove Movit;           // get rid of the action
    stop;                   // stop the robot
}
```



Invoking the Action (2)

- From C++ programs, the action can be invoked by using the corresponding **sfStartTask()** function. For example, here a typical invocation:

```
sfStartTask("Movit", NULL, 0, 10, 0, 1000, 95);
```

- Here the second argument is the instance name; the default NULL means it will be the same as the schema name. Timeout, priority, and suspension arguments are required, followed by the action parameters.

Turning Behavioural Action On

- Behavioural actions and direct actions can conflict if they are invoked at the same time.
- In situation like this, the direct actions always take priority.
- While the robot is executing direct actions, it turns off the output of behavioural actions.
- In fact, whenever a direct action is executed, behavioural actions remain off until they are explicitly turned back on.
- To turn behavioural actions on, use the **behaviors** command in Colbert, or the longer C++ function: ***sfROBOT->clearDirectMotion()***



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