TMcraft Tutorial FreeBot by Virtual Key

Original Instructions

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Revision History

Revision	Date	Description
1.0	2024-10-18	Original release

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1. Introduction

In some cases, developers might want to implement a method to enable FreeBot without pressing the FreeBot button on the end-effector, especially if the tool is enormous and using the button is difficult. This document explains how to activate FreeBot with TMcraft API. Readers should have the following prerequisites:

- Basic knowledge on programming C# and WPF
- Having read *TMcraft Toolbar Tutorial: Basic Development*
- Having read *TMcraft Toolbar API Function Manual*

Based on TMcraft.dll version 1.16, this tutorial.

IMPORTANT:
When freebot (hand-guide) is enable through FreeBotProvider functions, the speed limit of the Safety System will be the safety tool value of either the performance safety or the human-machine safety, according to the current operation mode. Developers should have safety evaluation according to ISO 10218-1 before implementing such feature on their TMcraft plugins.

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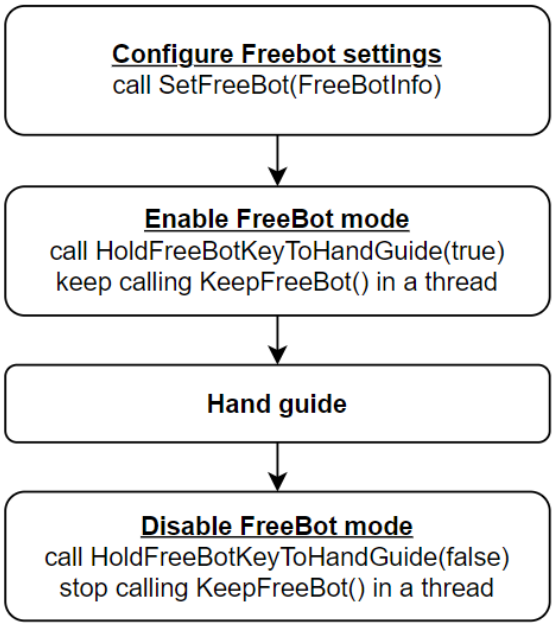
2. Concept



TMcraft API has added a new category of functions, FreeBotProvider, which consists of functions associated to FreeBot manipulation:

- GetFreeBot (FreeBotInfo): Get the current FreeBot settings.
- HoldFreeBotKeyToHandGuide(bool): Mimics holding the FreeBot button in order to enable FreeBot.
- KeepFreeBot(): Users must continuously call this function to keep FreeBot enabled. In case of an unexpected program crash, the KeepFreeBot() signal will be terminated and disable FreeBot.
- SetFreeBot(FreeBotInfo): Modifies the FreeBot settings.

IMPORTANT:
Since version 1.20, the API functions RobotStatusProvider.GetFreeBot and RobotStatusProvider.SetFreeBot have been deprecated.

To trigger Freebot through TMcraft API, modifies the FreeBot settings first. Then, calls HoldFreeBotKeyToHandGuide(true) while simultaneously enables a thread to continuously call KeepFreeBot(). After the hand guiding is finished, disables the KeepFreeBot() thread and calls KeyToHandGuide(false) to disable FreeBot.

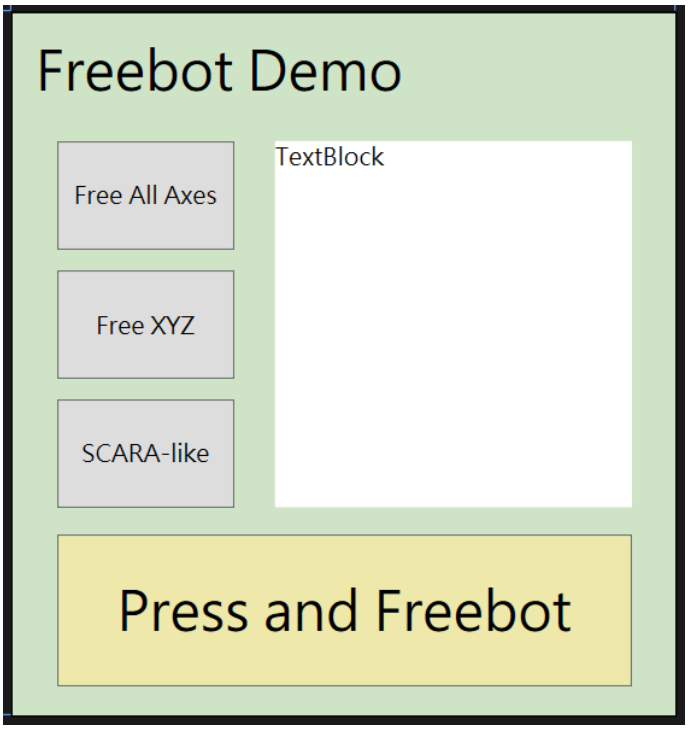
3. Sample Code

This section demonstrates using TMcraft Toolbar to manipulate FreeBot by describing the essential parts of the sample code. For details, please refer to TMcraft Development Kit sample code: FreebotByVirtualButton.

3.1 MainPage.xaml

MainPage.xaml defines the UI, which includes:

- Btn_FreeAll: click to modify the FreeBot mode to free all joints.
- Btn_FreeXYZ: click to modify the FreeBot mode to free all joints.
- Btn_Scara: click to start or stop jogging
- TextB_Main: displays messages, such as current FreeBot settings, error messages, etc.
- Btn_Freebot: click to enable/disable FreeBot.



3.2 MainPage.xaml.cs

- The tutorial will focus on how enabling FreeBot works. First, declare the global variables required.

```
public partial class MainPage : UserControl, ITMcraftToolbarEntry
{
    TMcraftToolbarAPI ToolbarUI;
    FreeBotInfo _freebot;
    bool FreebotStatus = false;
    CancellationTokenSource cts = new CancellationTokenSource();
    Thread th_KeepFreebot;
```

- Definition of the thread function _KeepFreeBot. If FreebotStatus is true, the thread will keep calling FreeBotProvider.KeepFreeBot().

```
private void _KeepFreebot(CancellationToken token)
{
    while (!token.IsCancellationRequested)
    {
        if (FreebotStatus)
        {
            ToolbarUI.FreeBotProvider.KeepFreeBot();
        }

        Thread.Sleep(150); //100-500ms
    }
}
```

- Definition of Btn_FreeBot_Click.

1. Disables the button first and checks if the Toolbar connects to TMflow or not.

```
Btn_Freebot.IsEnabled = false;
if (ToolbarUI == null || ToolbarUI.FreeBotProvider == null)
{
    TextB_Main.Text = "No connection";
    Btn_Freebot.IsEnabled = true;
    return;
}
```

2. Verifies the FreebotStatus. If it is false, calls FreeBotProvider.HoldFreeBotKeyTo-HandGuide(true) and activates the thread _KeepFreeBot in order to enable FreeBot. Then, sets true to FreebotStatus, modifies the button style and enables the button again.

```
if(!FreebotStatus)
{
    ToolbarUI.FreeBotProvider.HoldFreeBotKeyToHandGuide
   (true);
    FreebotStatus = true;
    //th_KeepFreebot = new Thread(_KeepFreebot);
    //th_KeepFreebot.Start();

    Btn_Freebot.Content = "Press to disable Freebot";
    Btn_Freebot.Background = Brushes.PaleVioletRed;
    Btn_Freebot.IsEnabled = true;
}
```

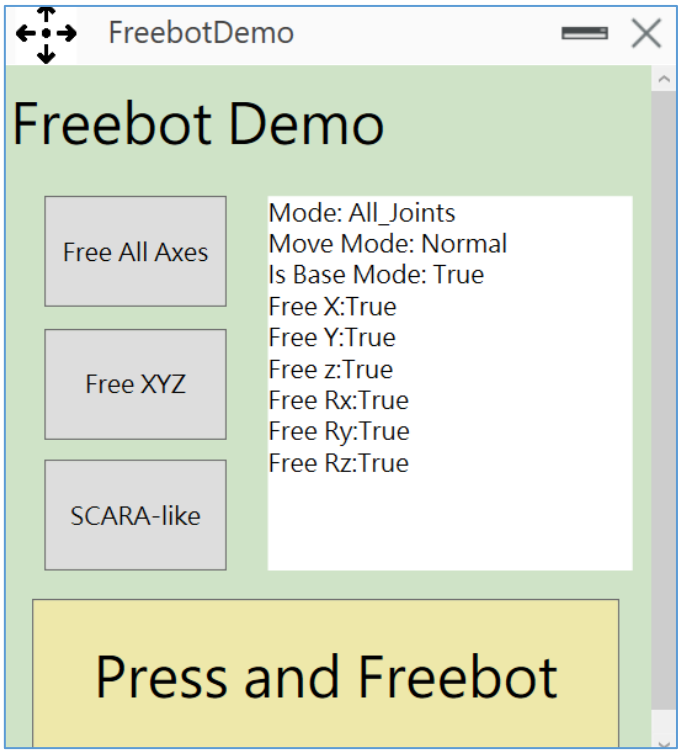
3. On the other hand, if FreebotStatus is true, call FreeBotProvider.HoldFreeBotKeyTo-HandGuide (false) and deactivates the thread _KeepFreeBot in order to disable FreeBot.to

halt the jogging. Then, sets false to FreebotStatus, modifies the button style and enables the button again.

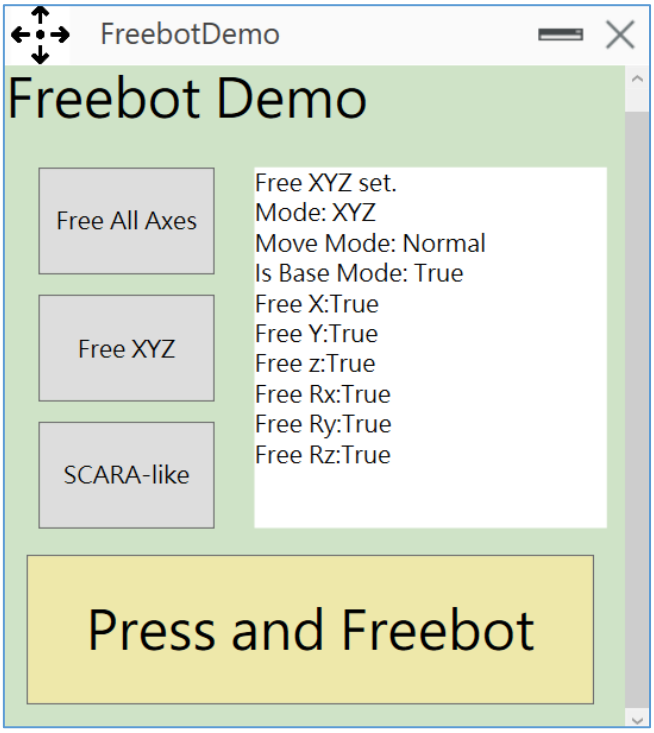
```
if (!JogStatus)...
else
{
    ShellUI.RobotJogProvider.HoldPlayKeyToRun(false);
    JogStatus = false;

    th_KeepJog.Join();
    ShellUI.RobotJogProvider.StopJog();

    Btn_Jog.Content = "Start Jogging";
    Btn_Jog.Background = Brushes.LightSeaGreen;
}
```

4. Result

Package the TMcraft toolbar, import it, and enable it on TMflow. Run the toolbar, and users will see the current FreeBot settings.

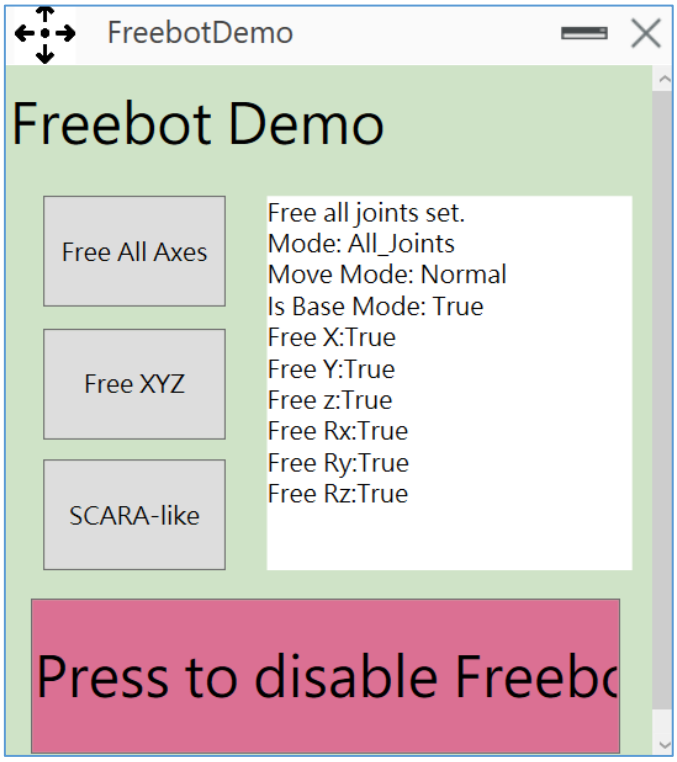


Click one of the FreeBot settings, and the result will be in the textbox.



Press the button below to enable FreeBot. After finishing the hand guide, click the button again to lock

the robot joints.

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