Sri Lanka Institute of Information Technology

Software Architecture (SE3030)

Assignment 01 - Micro-Kernel Architecture

2019

Submitted by:

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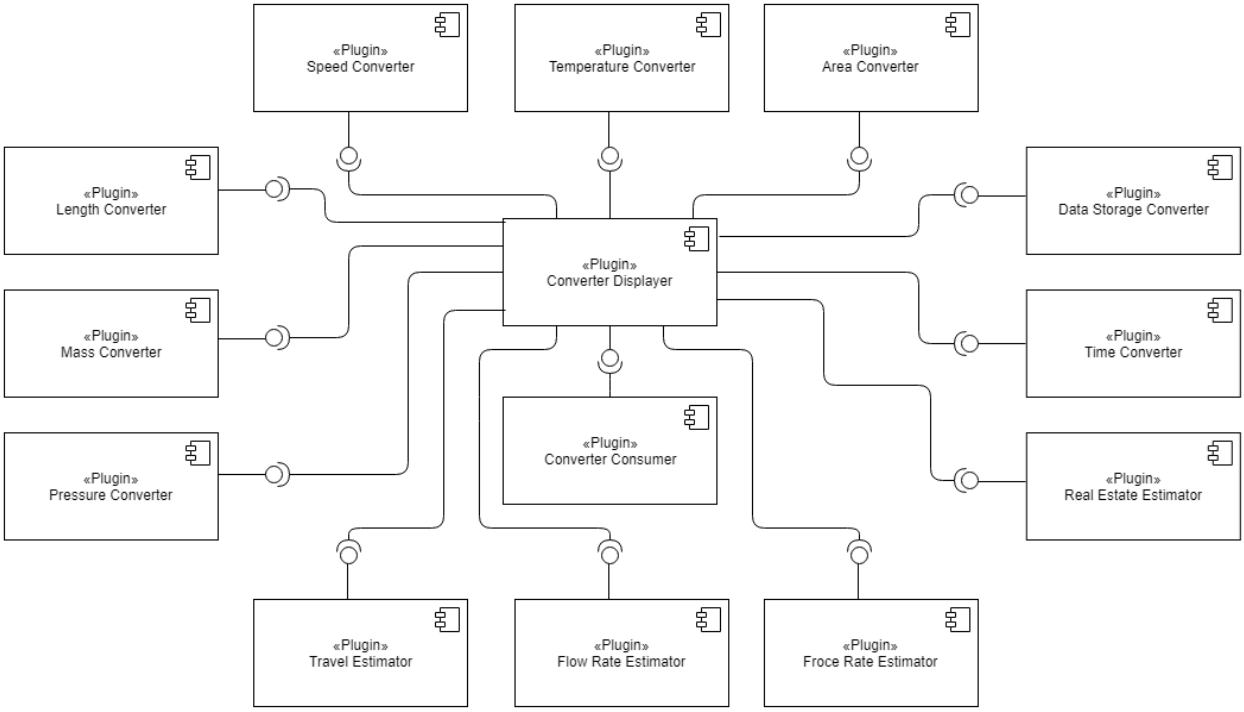
Introduction

The Loops' Smart Converter Tool Set provides a range of Unit Converters for Time, Area, Distance, Mass, Temperature, Pressure, Speed and Data Storage as well as it includes a set of Estimators which were built on previously mentioned set of Units. Estimators include Travel Estimator, Flow Rate Estimator, Real Estate Estimators and Force Rate Estimator. All these different Estimators are performing a set of complex functionalities which hides the chained implementation from the user.



Description

This component diagram consists of 14 plugin components including a core system(Converter Displayer),Service Consumer(Converter Consumer) and Service plug-in modules. Application logic is divided between independent plug-in modules and the basic core system. The core system contains only the minimal functionality required to make the system operational and provide flexible and extensible custom processing logic for application functionalities. The following section includes the functionalities and implementation of each and every Converters and Estimators in **Loops' Smart Converter Tool Set** to interact with user, providing a better experience**.**

Real Estate Estimator

Real Estate Estimator is the combination of Area Conversion and Real-time Currency conversion, it's been implemented in order to fulfill the feasibility requirement popped up in Real estate business. Requirement is since different part of world uses different Area measuring scales and Currency rate practices in real estate industry, when the business person involved in business across different countries this estimator tool will become handy.

This estimator request input parameters such as input Currency Unit , input Area unit , price of unit area along with output Currency unit and output area unit result is expected. Unique feature about this conversion is we fetch the real time currency conversion online and perform the chain of operation for manipulation.

Flow Rate Estimator

Flow Rate Estimator is the combination of Volume Conversion, Rate Conversion and Time Conversion, it's been implemented in order to fulfill the feasibility requirement arise in Large Production industries. Where we estimate the time, effort and cost required in order to plan the production process in an effective manner. We developed this estimator considering various volume measuring scales that are been widely used in Production industries.

This estimator request input parameters such as input Volume (Centimeter, Meter, Feet), input Volume Flow Rate (Cubic centimeter/second, Cubic Centimeter/minute, Cubic Centimeter/hour) and input Time (Seconds, Minutes, Hours). Unique feature about this conversion is we can independently select any of the two input variables in order to find the result of third argument.

Travel Estimator

Travel Estimator is the combination of Distance Conversion, Speed Conversion and Time Conversion, it's been implemented in order to fulfill the feasibility requirement arise in Large Travel industries. Where we estimate the time, effort and cost required in order to plan the production process in an effective manner. We developed this estimator considering various Travel measuring scales that are been widely used in Travel industries.

This estimator request input parameters such as input Distance (Meter, Kilometer, Mile), input Speed (Meter per Second, Kilometer per Hour , Mile per Hour) and input Time (Seconds, Minutes, Hours). Unique feature about this conversion is we can independently select any of the two input variables in order to find the result of third argument.

Force Rate Estimator

Force Rate Estimator is the combination of Pressure Conversion, Area Conversion and Force Conversion, it's been implemented in order to fulfill the feasibility requirement arise in Large Production industries. Where we estimate the Pressure, effort and cost required in order to plan the production process in an effective manner. We developed this estimator considering various Force Rate measuring scales that are been widely used in Production industries.

This estimator request input parameters such as input Pressure (Pascal, Centipascal, and Decipascal), input Speed ($Meter^2$, $Centimeter^2$, $Millimeter^2$) and input Force (Newton). Unique feature about this conversion is we can independently select any of the two input variables in order to find the result of third argument.

Area Unit Converter

This is core converter performs a conversion of Area scale from and to Units such as Meter Squared (m^2), Kilometer Squared (Km^2), Square Feet, Acres, and Hectares .The user interface provides the two drop down list to input the predefined Area units and Two text field where one is used for providing the area amount to be converted and other for displaying converted value.

Time Unit Converter

This is core converter performs a conversion of Time scale from and to Units such as Seconds, Minutes, Hours, and Days .The user interface provides the two drop down list to input the predefined Time units and Two text field where one is used for providing the time amount to be converted and other for displaying converted value.

Speed Unit Converter

This is core converter performs a conversion of Speed scale from and to Units such as Meter per second (ms^{-1}), Foot per second, Kilometer per hour (kmh^{-1}), Miles per Hour, and Knot .The user interface provides the two drop down list to input the predefined Speed units and Two text field where one is used for providing the speed amount to be converted and other for displaying converted value.

Temperature Unit Converter

This is core converter performs a conversion of Time scale from and to Units such as Celsius(^{o}C) , Fahrenheit(^{o}F) and Kelvin(K) .The user interface provides the two drop down list to input the predefined Temperature units and Two text field where one is used for providing the temperature amount to be converted and other for displaying converted value.

Mass Unit Converter

This is core converter performs a conversion of Mass scale from and to Units such as Gram (g), Kilogram (Kg), Milligram (mg), Metric ton and Pounds .The user interface provides the two drop down list to input the predefined Mass units and Two text field where one is used for providing the mass amount to be converted and other for displaying converted value.

Length Unit Converter

This is core converter performs a conversion of Time scale from and to Units such as Meter (m), Kilometer (Km), Centimeter (cm), Millimeter (mm) and Inches .The user interface provides the two drop down list to input the predefined Length units and Two text field where one is used for providing the length amount to be converted and other for displaying converted value.

Pressure Unit Converter

This is core converter performs a conversion of Pressure scale from and to Units such as Gram (g), Kilogram (Kg), Milligram (mg), Metric ton and Pounds .The user interface provides the two drop down list to input the predefined Mass units and Two text field where one is used for providing the mass amount to be converted and other for displaying converted value.

Data Transfer Unit Converter

This is core converter performs a conversion of Time scale from and to Units such as Meter (m), Kilometer (Km), Centimeter (cm), Millimeter (mm) and Inches .The user interface provides the two drop down list to input the predefined Length units and Two text field where one is used for providing the length amount to be converted and other for displaying converted value.

Bundle's Manifest

1. Area Converter Bundle

AreaConverter

```
Manifest-Version: 1.0
Bundle-ManifestVersion: 2
Bundle-Name: AreaConverter
Bundle-SymbolicName: AreaConverter
Bundle-Version: 1.0.0.qualifier
Bundle-Activator: area.converter.service.AreaConverterActivator
Bundle-RequiredExecutionEnvironment: JavaSE-1.8
Automatic-Module-Name: AreaConverter
Import-Package: org.osgi.framework;version="1.3.0"
Bundle-ActivationPolicy: lazy
Export-Package: area.converter.service

```

2. Mass Converter Bundle

MassConverter

```
Manifest-Version: 1.0
Bundle-ManifestVersion: 2
Bundle-Name: MassConverter
Bundle-SymbolicName: MassConverter
Bundle-Version: 1.0.0.qualifier
Bundle-Activator: mass.converter.service.MassConverterActivator
Bundle-RequiredExecutionEnvironment: JavaSE-1.8
Automatic-Module-Name: MassConverter
Import-Package: org.osgi.framework;version="1.3.0"
Bundle-ActivationPolicy: lazy
Export-Package: mass.converter.service

```

3. Length Converter Bundle

LengthConverter

```
Manifest-Version: 1.0
Bundle-ManifestVersion: 2
Bundle-Name: LengthConverter
Bundle-SymbolicName: LengthConverter
Bundle-Version: 1.0.0.qualifier
Bundle-Activator: length.converter.service.LengthConverterActivator
Bundle-RequiredExecutionEnvironment: JavaSE-1.8
Automatic-Module-Name: LengthConverter
Import-Package: org.osgi.framework;version="1.3.0"
Bundle-ActivationPolicy: lazy
Export-Package: length.converter.service

```

4. Data Storage Converter Bundle

DataStorageConv

```
Manifest-Version: 1.0
Bundle-ManifestVersion: 2
Bundle-Name: DataStorage
Bundle-SymbolicName: DataStorageConvertor
Bundle-Version: 1.0.0.qualifier
Bundle-Activator: datastorage.converter.service.DataStorageConverterActivator
Bundle-RequiredExecutionEnvironment: JavaSE-1.8
Import-Package: org.osgi.framework;version="1.3.0"
Automatic-Module-Name: DataStorage
Export-Package: datastorage.converter.service

```

5. **Estimator Bundle**

Estimator

```
Manifest-Version: 1.0
Bundle-ManifestVersion: 2
Bundle-Name: Estimator
Bundle-SymbolicName: Estimator
Bundle-Version: 1.0.0.qualifier
Bundle-Activator: estimator.Activator
Require-Bundle: org.eclipse.ui,
  org.eclipse.core.runtime
Bundle-RequiredExecutionEnvironment: JavaSE-1.8
Automatic-Module-Name: Estimator
Bundle-ActivationPolicy: lazy
Import-Package: area.converter.service
Export-Package: estimator

```

6. **Converter Displayer Bundle**

ConverterDispla

```
Manifest-Version: 1.0
Bundle-ManifestVersion: 2
Bundle-Name: ConverterDisplayer
Bundle-SymbolicName: ConverterDisplayer
Bundle-Version: 1.0.0.qualifier
Bundle-Activator: converter.displayer.service.ServiceActivator
Bundle-Vendor: MTIT
Bundle-RequiredExecutionEnvironment: JavaSE-1.8
Automatic-Module-Name: ConverterDisplayer
Import-Package: area.converter.service,
 datastorage.converter.service,
 estimator,
 length.converter.service,
 mass.converter.service,
 org.osgi.framework;version="1.3.0",
 org.osgi.util.tracker;version="1.5.2",
 pressure.converter.service,
 pressure.estimater.service.estimatorpressure,
 speed.converter.service,
 temperature.converter.service,
 time.converter.service,
 travel.estimator.service,
 volume.estimator.service
Bundle-ActivationPolicy: lazy
Export-Package: converter.displayer.service

```

7. Estimator Pressure Bundle

EstimaterPressure

```
Manifest-Version: 1.0
Bundle-ManifestVersion: 2
Bundle-Name: EstimatorPressure
Bundle-SymbolicName: EstimaterPressure
Bundle-Version: 1.0.0.qualifier
Bundle-Activator: pressure.estimater.service.estimatorpressure.EstimaterPressureActivator
Bundle-RequiredExecutionEnvironment: JavaSE-1.8
Import-Package: org.osgi.framework;version="1.3.0"
Automatic-Module-Name: EstimatorPressure
Export-Package: pressure.estimater.service.estimatorpressure

```

8. Temperature Converter Bundle

TemperatureConverter

```
Manifest-Version: 1.0
Bundle-ManifestVersion: 2
Bundle-Name: TemperatureConverter
Bundle-SymbolicName: TemperatureConverter
Bundle-Version: 1.0.0.qualifier
Bundle-Activator: temperature.converter.service.TemperatureConverterActivator
Bundle-RequiredExecutionEnvironment: JavaSE-1.8
Automatic-Module-Name: TemperatureConverter
Import-Package: org.osgi.framework;version="1.3.0"
Bundle-ActivationPolicy: lazy
Export-Package: temperature.converter.service

```

9. Speed Converter Bundle

SpeedConverter

```
Manifest-Version: 1.0
Bundle-ManifestVersion: 2
Bundle-Name: SpeedConverter
Bundle-SymbolicName: SpeedConverter
Bundle-Version: 1.0.0.qualifier
Bundle-Activator: speed.converter.service.SpeedConverterActivator
Bundle-RequiredExecutionEnvironment: JavaSE-1.8
Automatic-Module-Name: SpeedConverter
Import-Package: org.osgi.framework;version="1.3.0"
Bundle-ActivationPolicy: lazy
Export-Package: speed.converter.service

```

10. Converter Consumer Bundle

ConverterConsumer

```
Manifest-Version: 1.0
Bundle-ManifestVersion: 2
Bundle-Name: ConverterConsumer
Bundle-SymbolicName: ConverterConsumer
Bundle-Version: 1.0.0.qualifier
Bundle-Activator: converter.consumer.service.ServiceActivator
Bundle-RequiredExecutionEnvironment: JavaSE-1.8
Automatic-Module-Name: ConverterConsumer
Import-Package: converter.displayer.service,
 org.osgi.framework;version="1.3.0"
Bundle-ActivationPolicy: lazy


```

11. Time Converter Bundle

TimeConverter

```
Manifest-Version: 1.0
Bundle-ManifestVersion: 2
Bundle-Name: TimeConverter
Bundle-SymbolicName: TimeConverter
Bundle-Version: 1.0.0.qualifier
Bundle-Activator: time.converter.service.TimeConverterActivator
Bundle-RequiredExecutionEnvironment: JavaSE-1.8
Automatic-Module-Name: TimeConverter
Import-Package: org.osgi.framework;version="1.3.0"
Bundle-ActivationPolicy: lazy
Export-Package: time.converter.service
```

12. Travel Estimator Bundle

TravelEstimator

```
Manifest-Version: 1.0
Bundle-ManifestVersion: 2
Bundle-Name: TravelEstimator
Bundle-SymbolicName: TravelEstimator
Bundle-Version: 1.0.0.qualifier
Bundle-Activator: travel.estimator.service.TravelEstimatorActivator
Bundle-RequiredExecutionEnvironment: JavaSE-1.8
Automatic-Module-Name: TravelEstimator
Import-Package: org.osgi.framework;version="1.3.0"
Bundle-ActivationPolicy: lazy
Export-Package: travel.estimator.service

```

13. Volume Converter Bundle

VolumeEstimator

```
Manifest-Version: 1.0
Bundle-ManifestVersion: 2
Bundle-Name: VolumeEstimator
Bundle-SymbolicName: VolumeEstimator
Bundle-Version: 1.0.0.qualifier
Bundle-Activator: volume.estimator.service.VolumeEstimatorActivator
Bundle-RequiredExecutionEnvironment: JavaSE-1.8
Automatic-Module-Name: VolumeEstimator
Import-Package: org.osgi.framework;version="1.3.0"
Bundle-ActivationPolicy: lazy
Export-Package: volume.estimator.service
```

14. Pressure Converter Bundle

PressureConverter

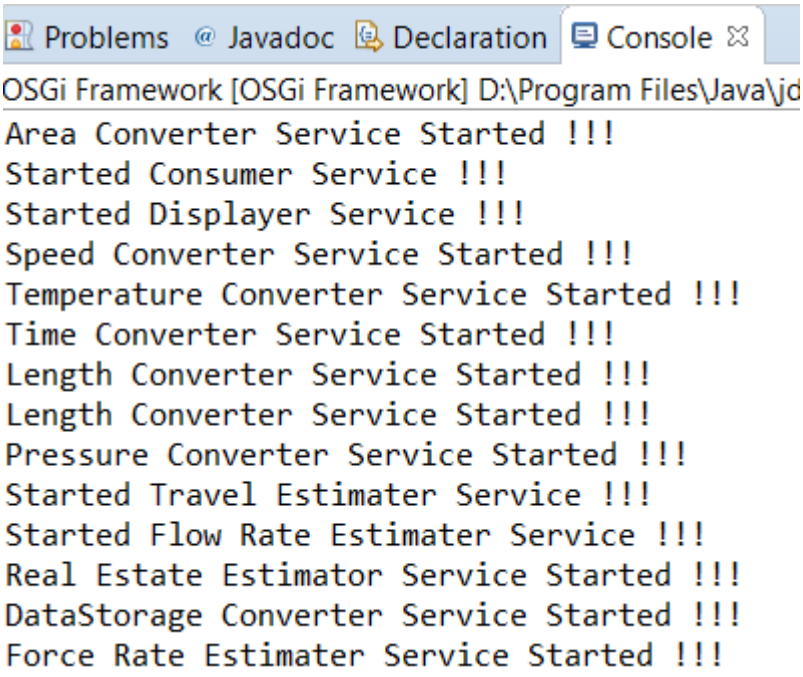
```
Manifest-Version: 1.0
Bundle-ManifestVersion: 2
Bundle-Name: PressureConverter
Bundle-SymbolicName: PressureConverter
Bundle-Version: 1.0.0.qualifier
Bundle-Activator: pressure.converter.service.PressureConverterActivator
Bundle-RequiredExecutionEnvironment: JavaSE-1.8
Automatic-Module-Name: PressureConverter
Import-Package: org.osgi.framework;version="1.3.0"
Bundle-ActivationPolicy: lazy
Export-Package: pressure.converter.service

```

How Project works with OSGI Plugin Framework

1. Since we use Eclipse Equinox as the OSGi development framework, Eclipse IDE implicitly handles the Bundle management such as Install, Resolve, Start, Stop etc. Therefore we only need to run the bundles as the OSGi framework

   Following Figure illustrates the start of bundles in the Project

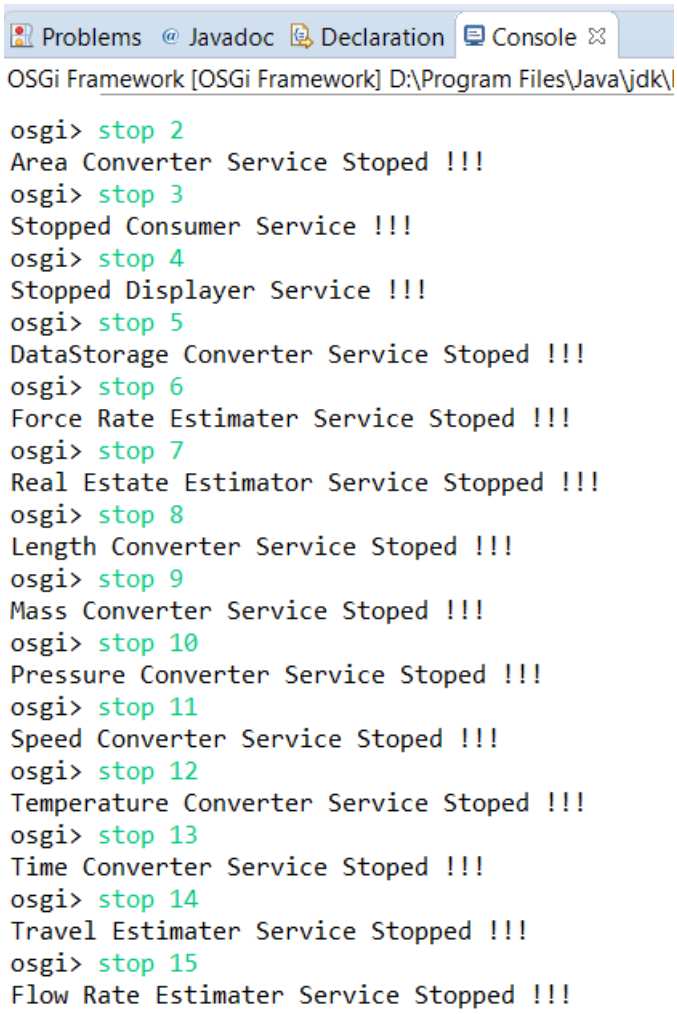


2. Each bundle is independent from each other, so that we can install and uninstall plugin bundles at runtime without affecting the whole system.

   This feature allows developing project as separate modules and integrate into the whole system incrementally as requirement arise. Following figure illustrate all the active bundles as soon as project is started

id	State	Bundle
2	ACTIVE	AreaConverter_1.0.0.qualifier
3	ACTIVE	ConverterConsumer_1.0.0.qualifier
4	ACTIVE	ConverterDisplayer_1.0.0.qualifier
5	ACTIVE	DataStorageConvertor_1.0.0.qualifier
6	ACTIVE	EstimaterPressure_1.0.0.qualifier
7	ACTIVE	Estimator_1.0.0.qualifier
8	ACTIVE	LengthConverter_1.0.0.qualifier
9	ACTIVE	MassConverter_1.0.0.qualifier
10	ACTIVE	PressureConverter_1.0.0.qualifier
11	ACTIVE	SpeedConverter_1.0.0.qualifier
12	ACTIVE	TemperatureConverter_1.0.0.qualifier
13	ACTIVE	TimeConverter_1.0.0.qualifier
14	ACTIVE	TravelEstimator_1.0.0.qualifier

Following figure illustrate the how individual plugin bundles can be stopped at runtime

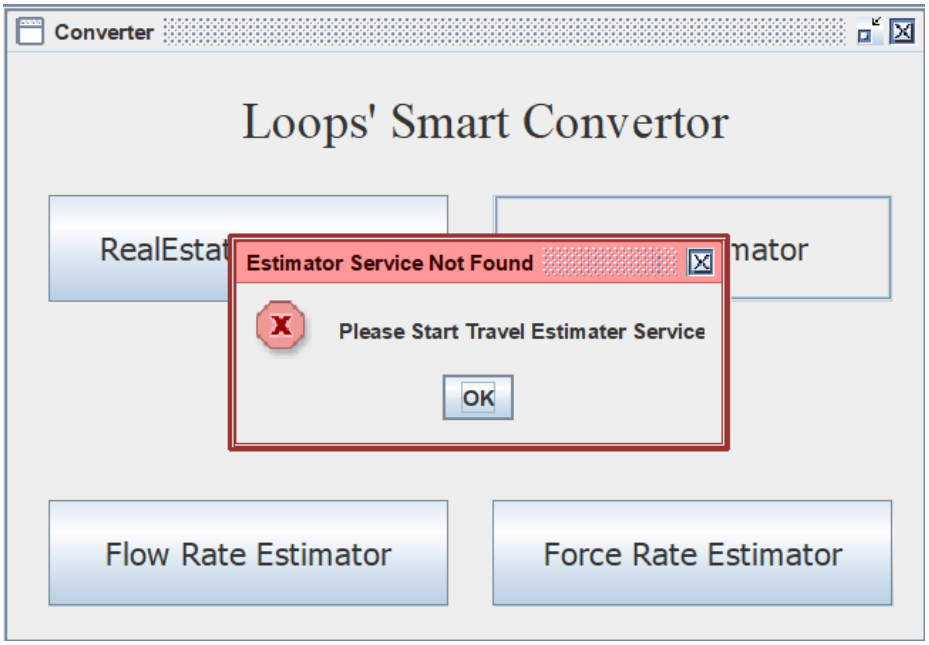


Following figure illustrate the state of plugin bundles when we stop them in runtime

```
2       RESOLVED    AreaConverter_1.0.0.qualifier
3       RESOLVED    ConverterConsumer_1.0.0.qualifier
4       RESOLVED    ConverterDisplayer_1.0.0.qualifier
5       RESOLVED    DataStorageConvertor_1.0.0.qualifier
6       RESOLVED    EstimaterPressure_1.0.0.qualifier
7       RESOLVED    Estimator_1.0.0.qualifier
8       RESOLVED    LengthConverter_1.0.0.qualifier
9       RESOLVED    MassConverter_1.0.0.qualifier
10      RESOLVED    PressureConverter_1.0.0.qualifier
11      RESOLVED    SpeedConverter_1.0.0.qualifier
12      RESOLVED    TemperatureConverter_1.0.0.qualifier
13      RESOLVED    TimeConverter_1.0.0.qualifier
14      RESOLVED    TravelEstimator_1.0.0.qualifier
15      RESOLVED    VolumeEstimator_1.0.0.qualifier
```

According to the project implementation, this allows service to be decoupled from the core system without the acknowledgement of client

Following figure show the Exception thrown by the system when client access the service which is being decoupled from the Core system at the run time



Later as per the requirement arise we can again couple the service which are required by the client at runtime.

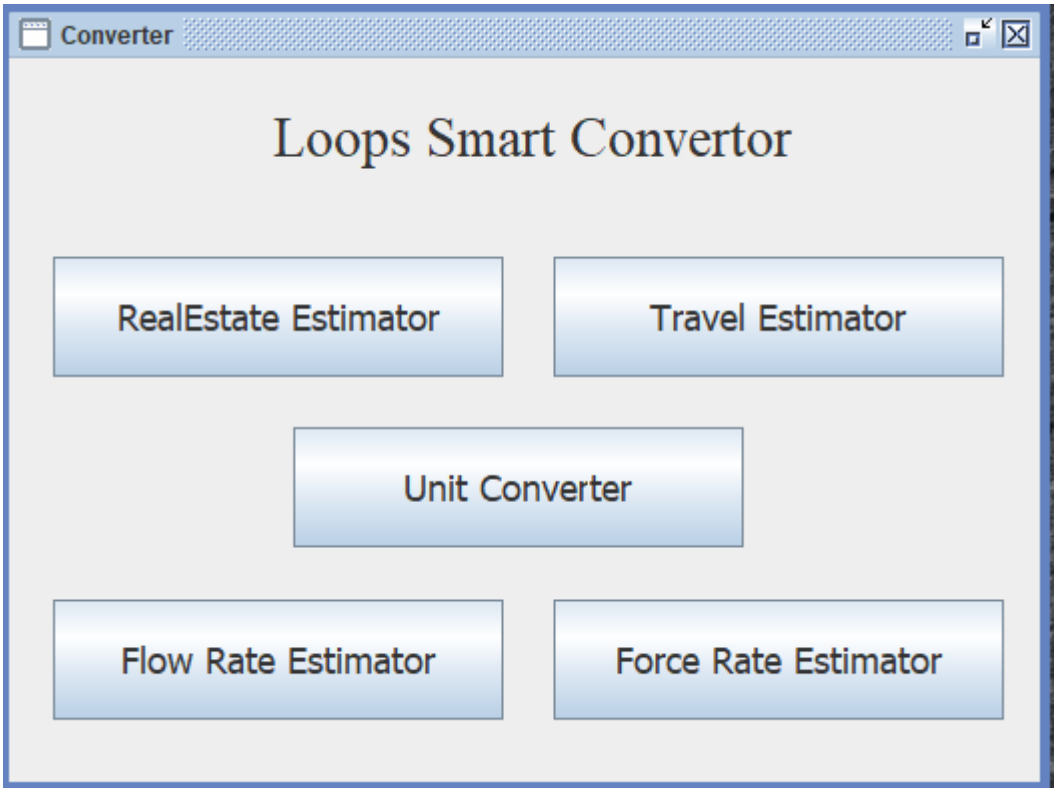
Following figure illustrate how we can start the individual plugin bundles which are being stopped earlier

```
osgi> start 4
Started Displayer Service !!!
osgi> start 3
Started Consumer Service !!!
osgi> start 2
Area Converter Service Started !!!
osgi> start 5
DataStorage Converter Service Started !!!
osgi> start 6
Force Rate Estimater Service Started !!!
osgi> start 7
Real Estate Estimator Service Started !!!
osgi> start 8
Length Converter Service Started !!!
osgi> start 9
Length Converter Service Started !!!
osgi> start 10
Pressure Converter Service Started !!!
osgi> start 11
Speed Converter Service Started !!!
osgi> start 12
Temperature Converter Service Started !!!
osgi> start 13
Time Converter Service Started !!!
osgi> start 14
Started Travel Estimater Service !!!
osgi> start 15
Started Flow Rate Estimater Service !!!
```

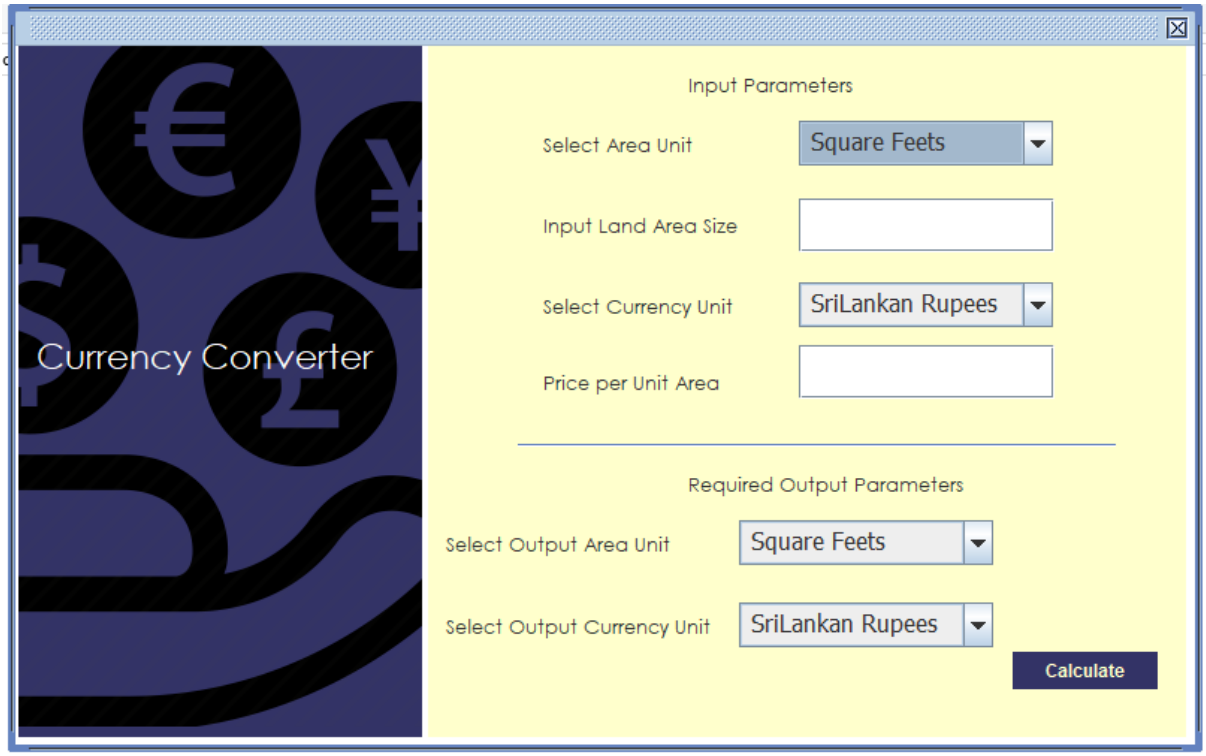
Bundle's Behavior and Outputs

1. Real Estate Estimator

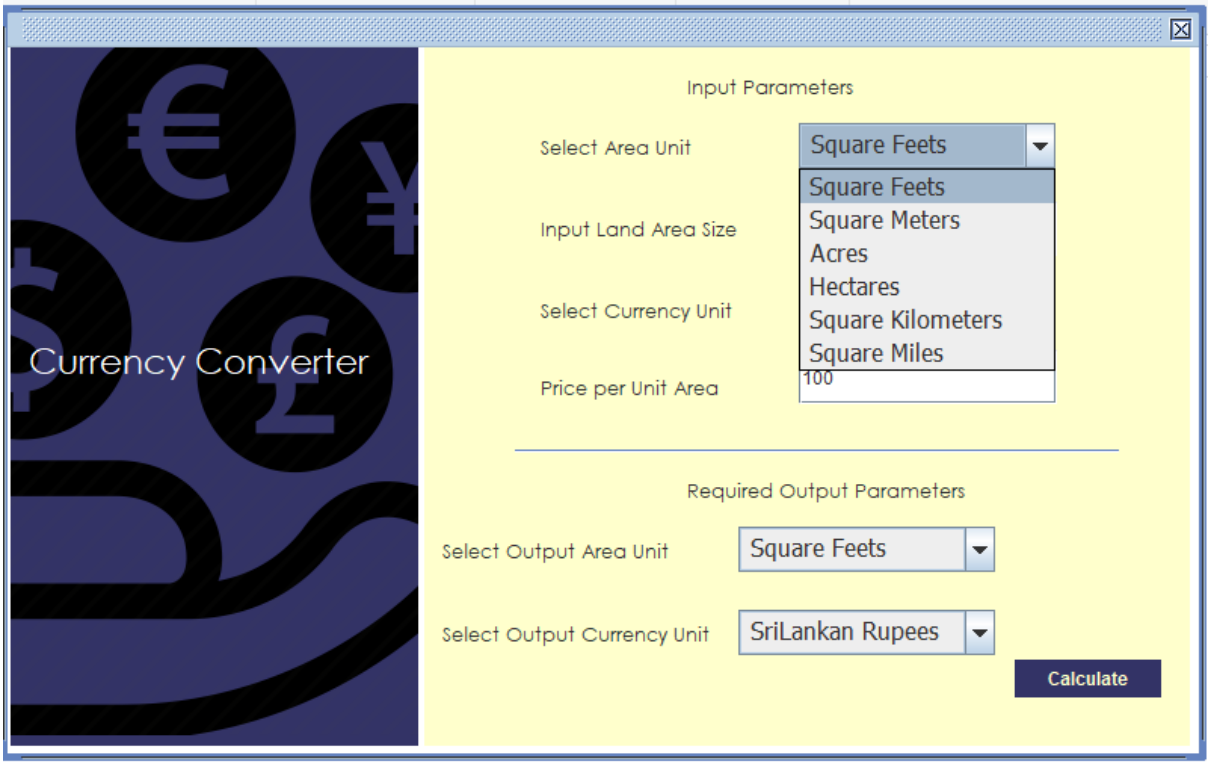
1.1 Run the Application and Select Real Estate Estimator



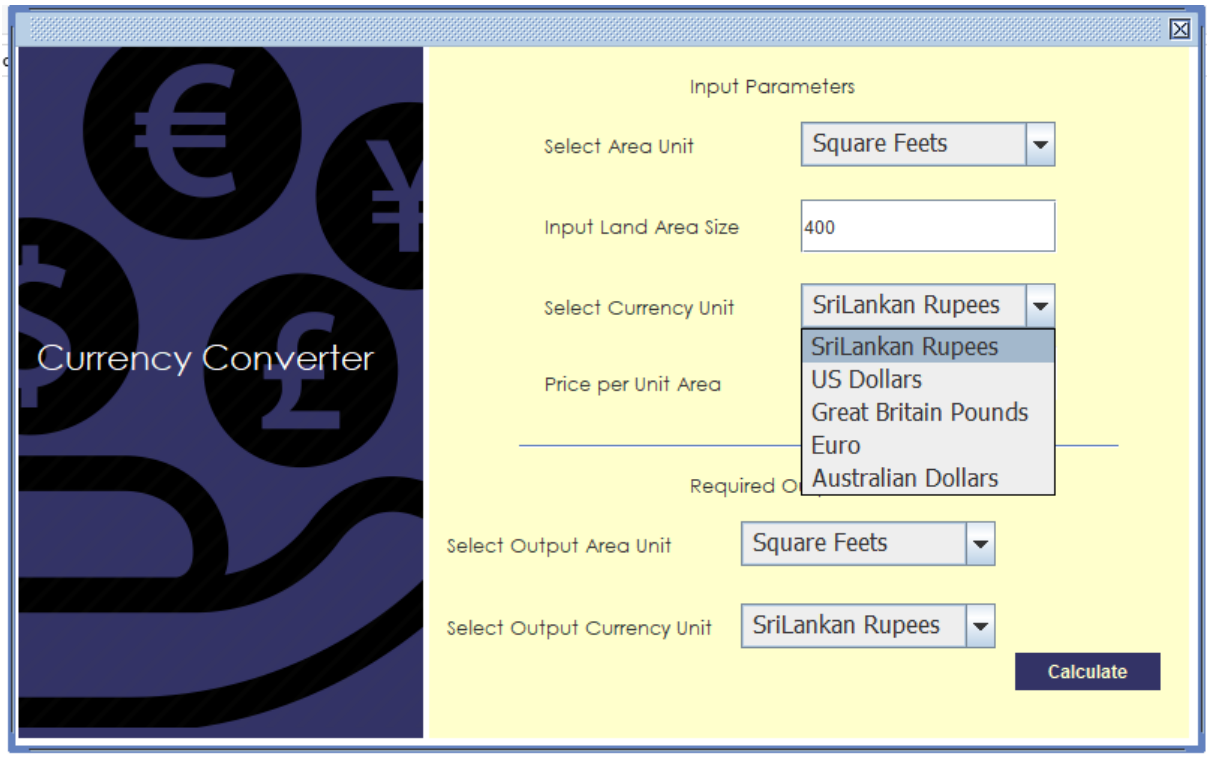
1.2 Real Estate Estimator UI will be displayed



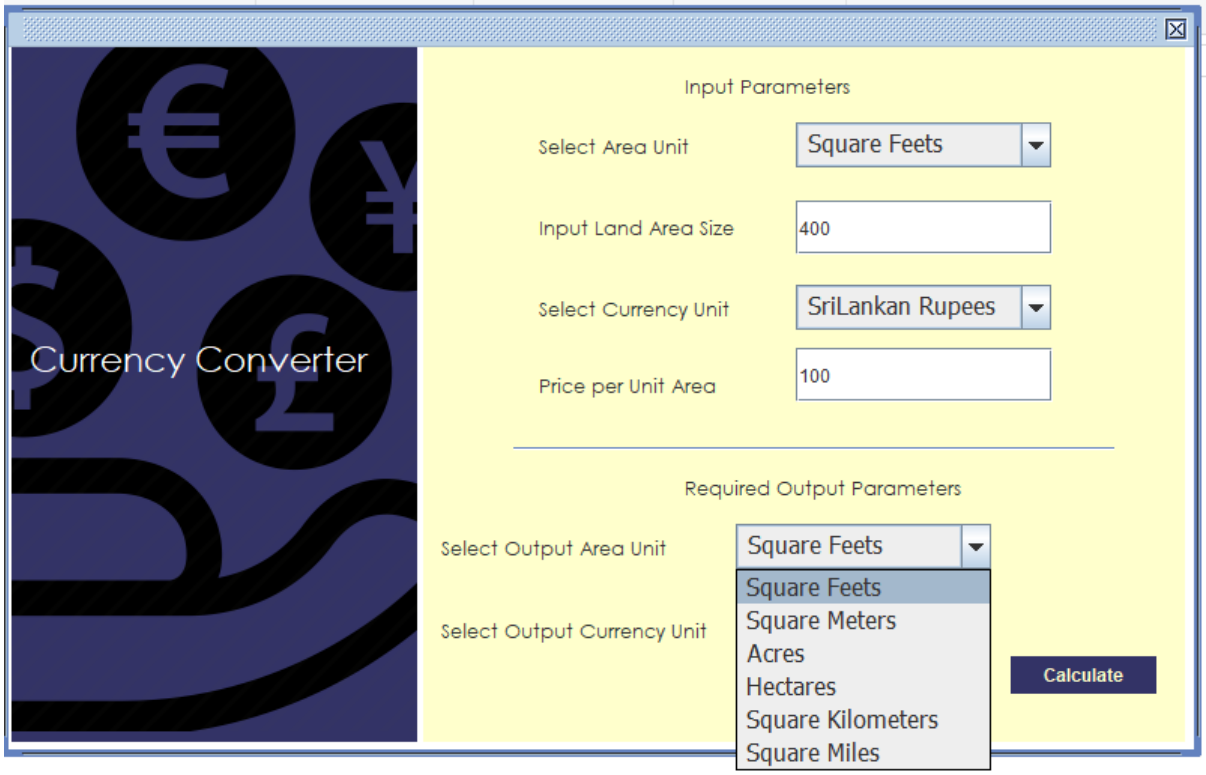
1.3 Select the Input Area Parameter Unit and Input the land Area Size



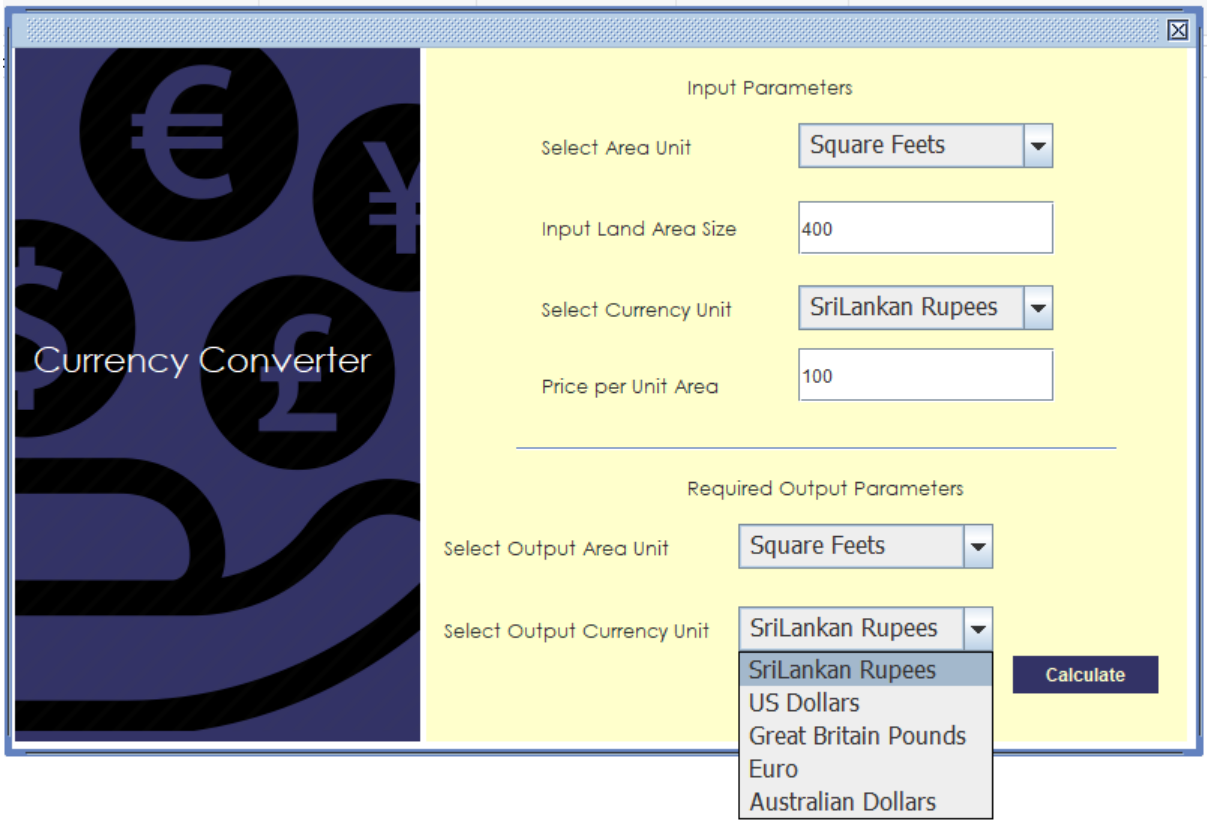
1.4 Select the currency unit & input the price per unit area



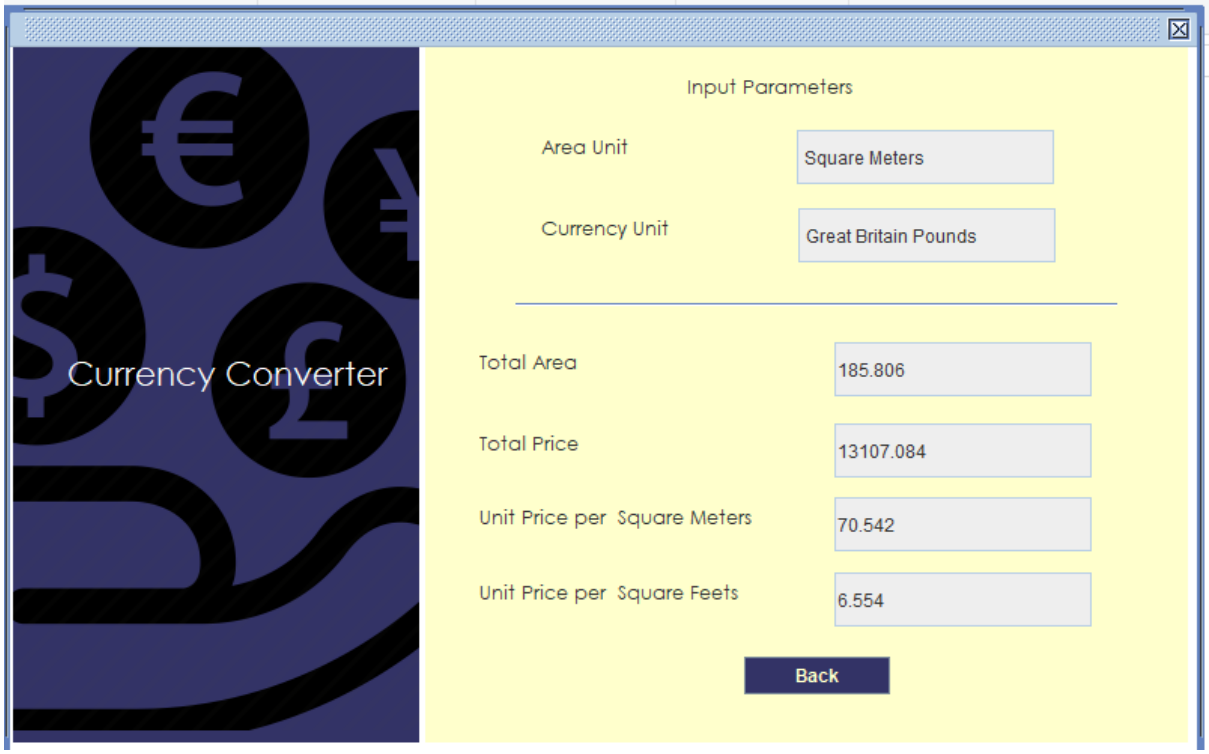
1.5 Select the Output Area Parameter Unit



1.6 Select the Output Currency Unit and Press Calculate button

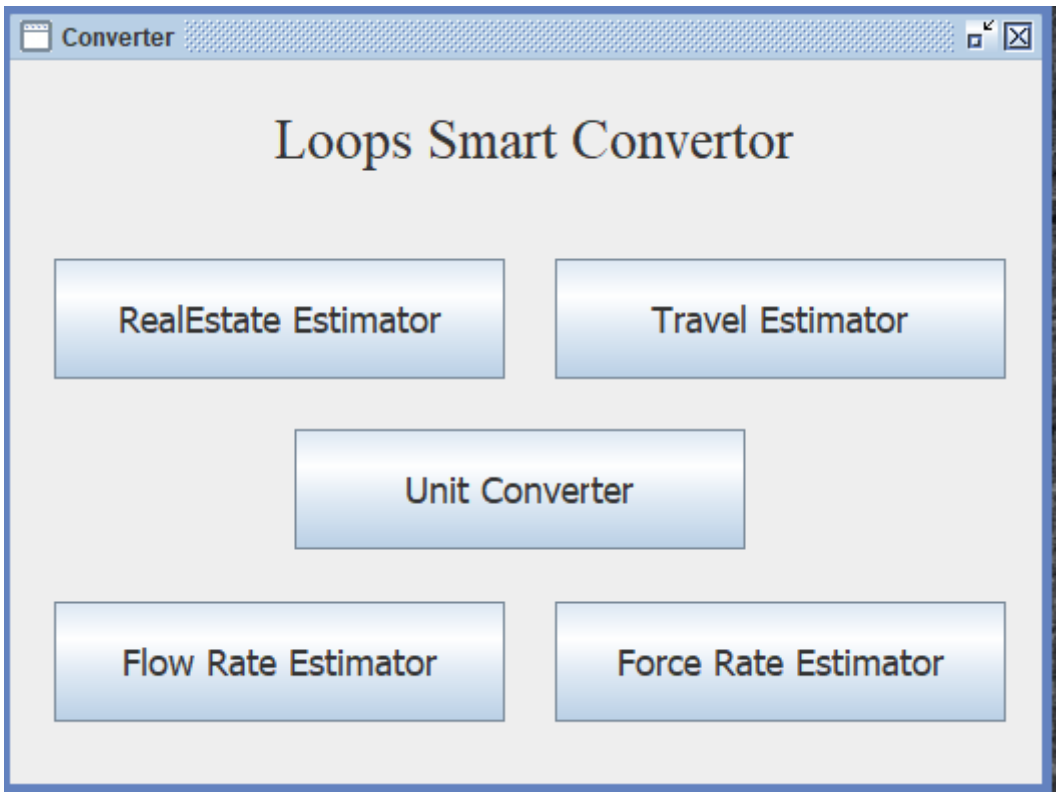


1.7 Display the Output

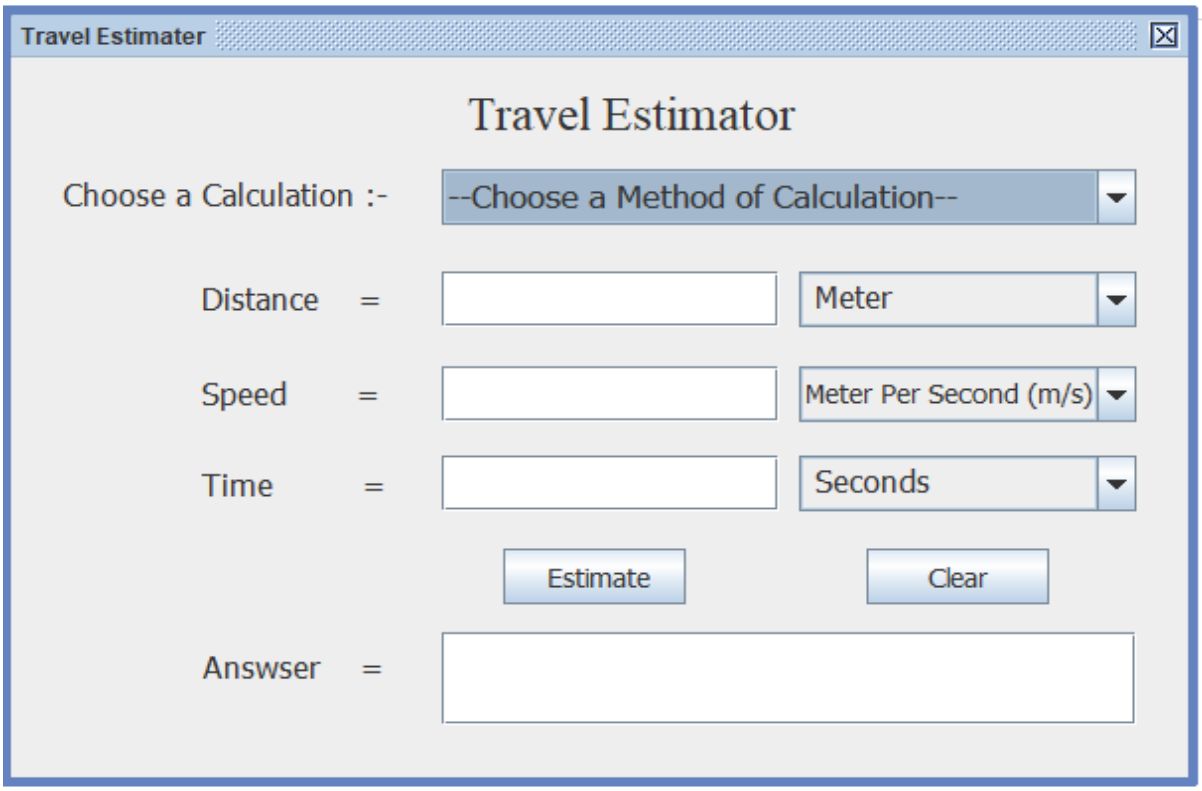


2. Travel Estimator

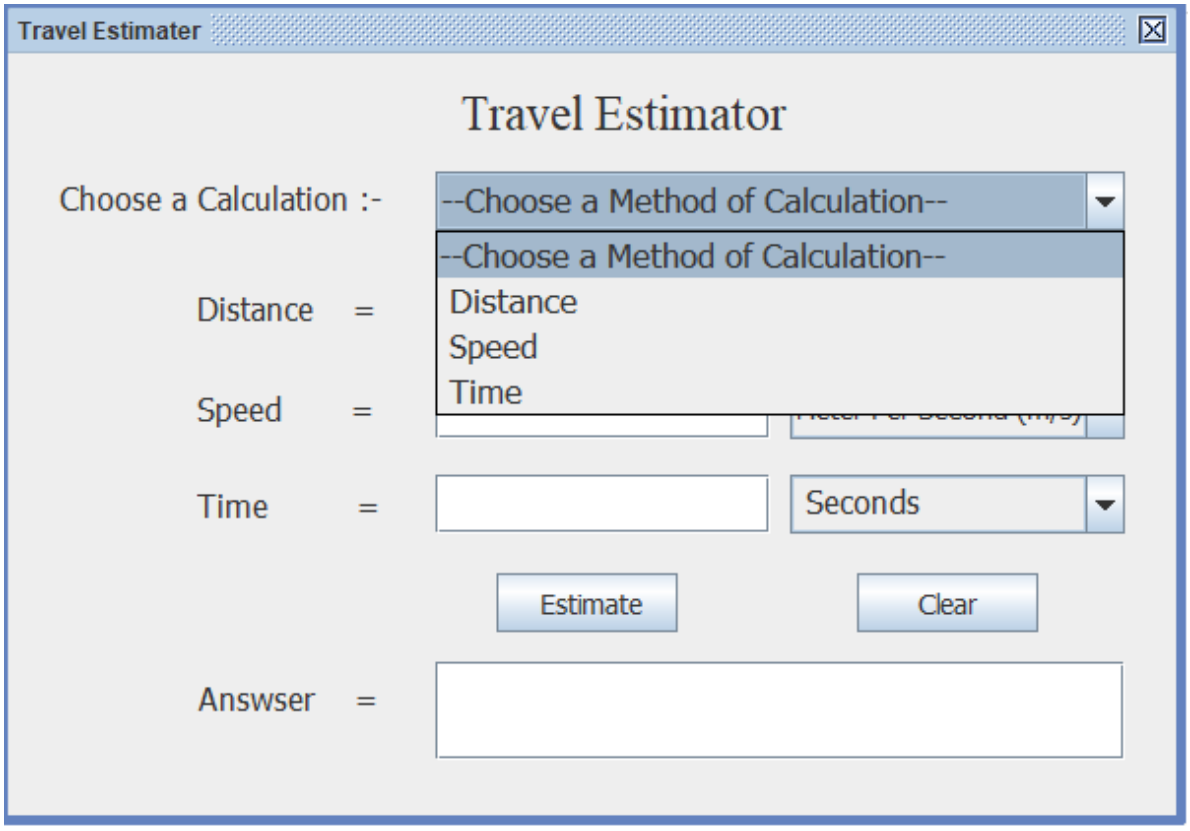
2.1 Run the Application and Select Travel Estimator



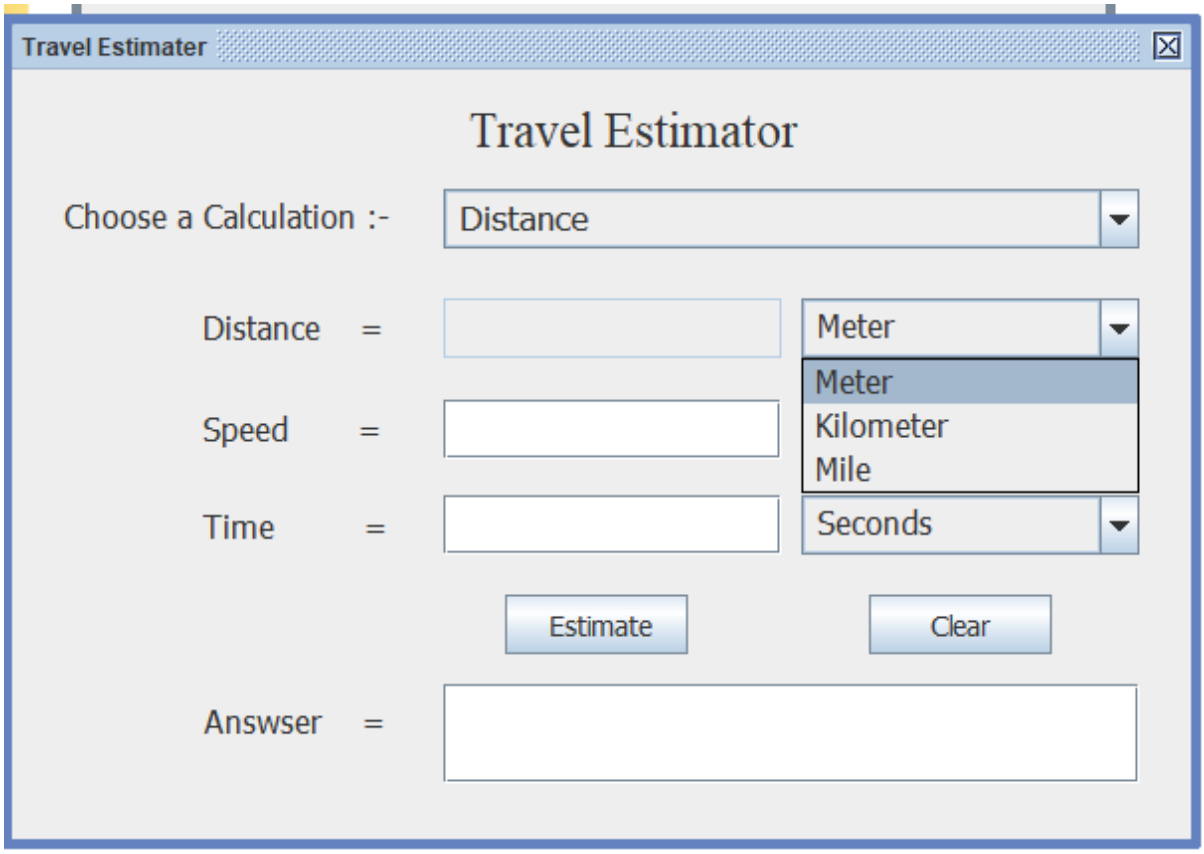
2.2 Travel Estimator UI will be displayed



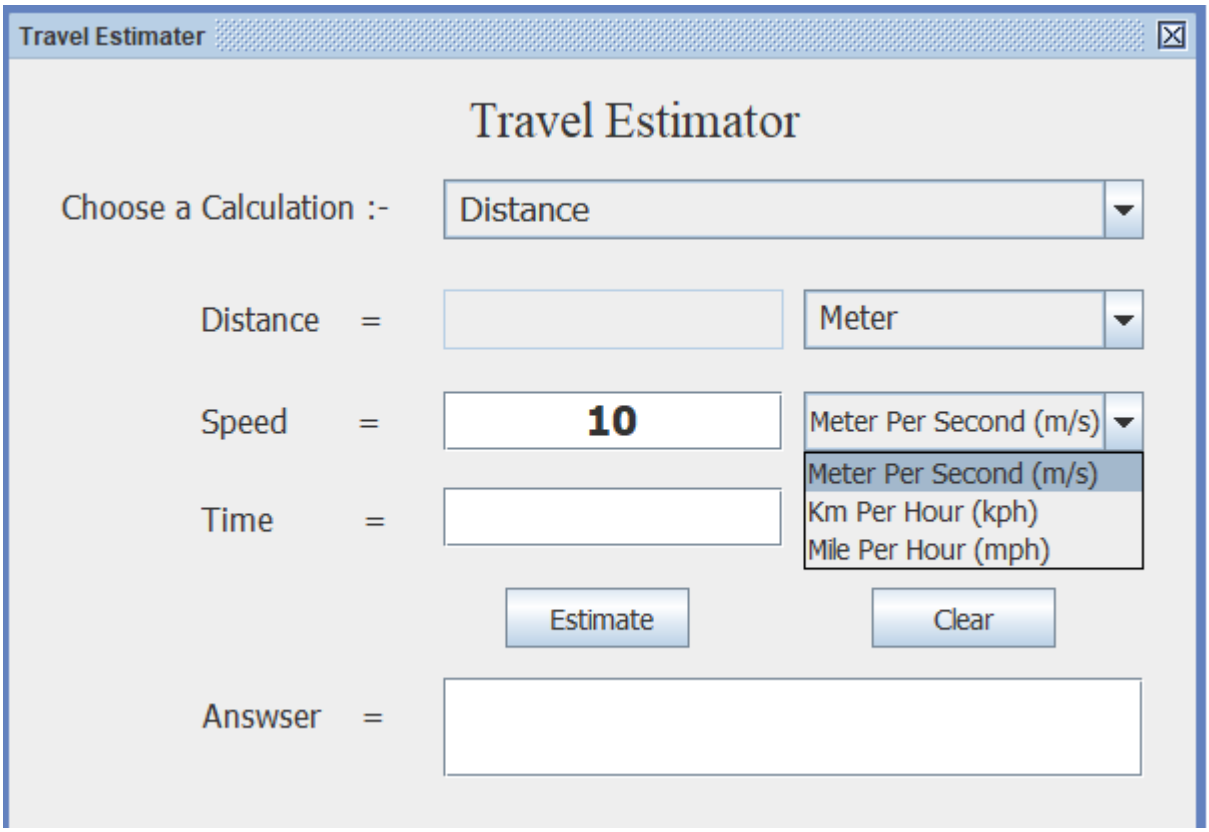
2.3 Choose the calculation method(e.g. :- Distance)



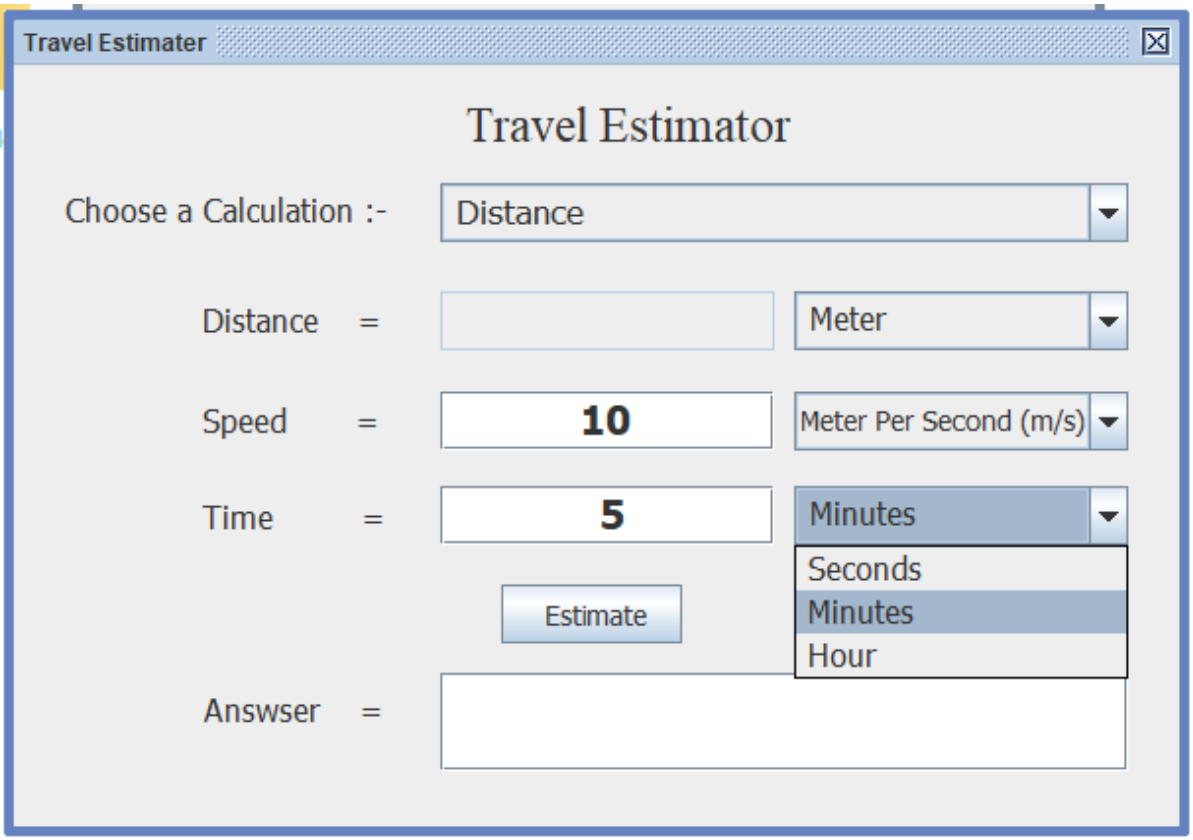
2.4 Select the Output Unit type for Distance



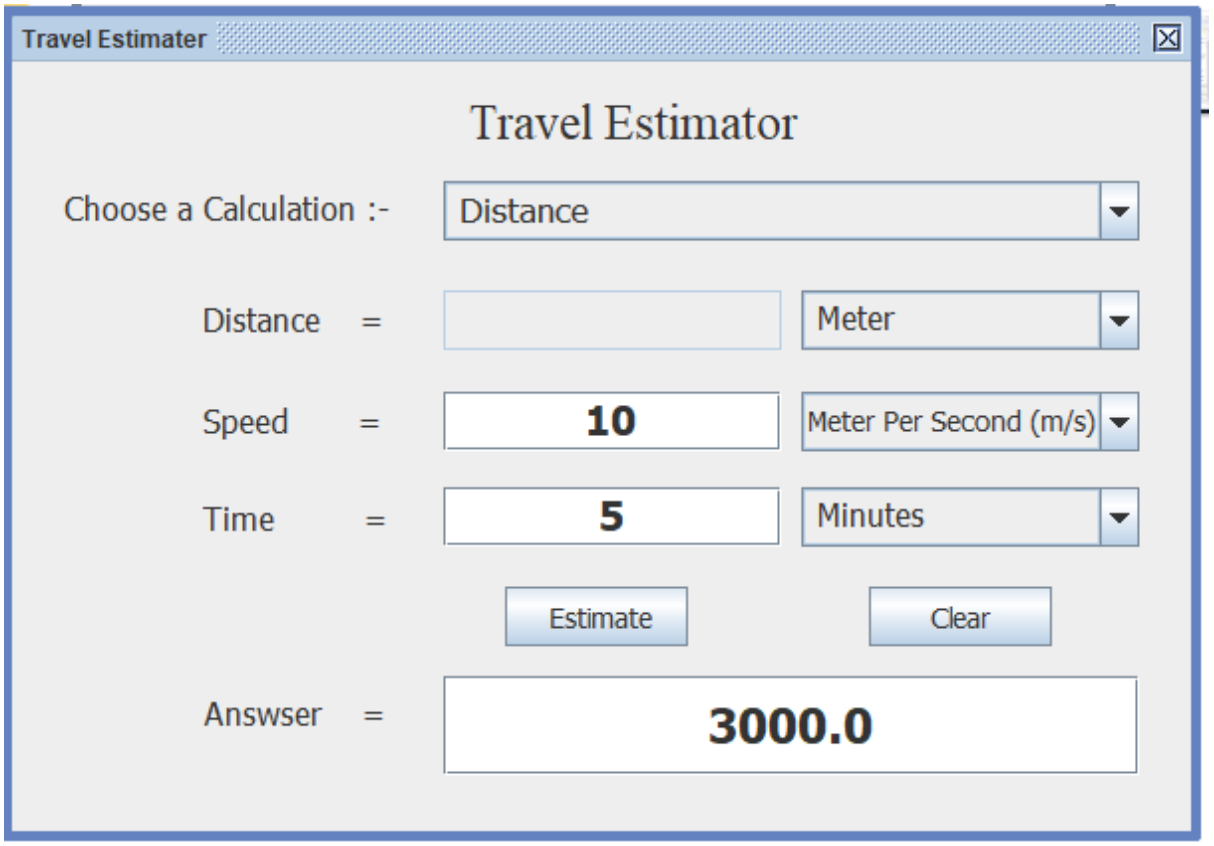
2.5 Input the Speed value and Select the Speed Option



2.6 Input the Time value and Select the Time Option

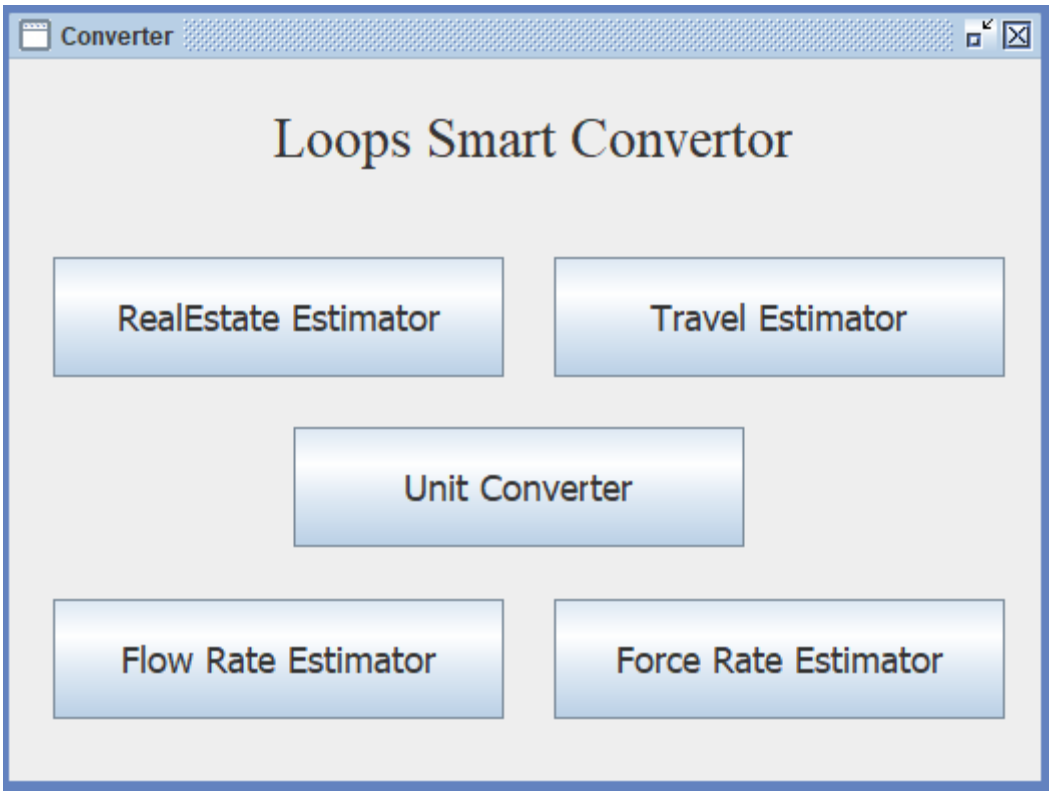


2.7 Display the Output

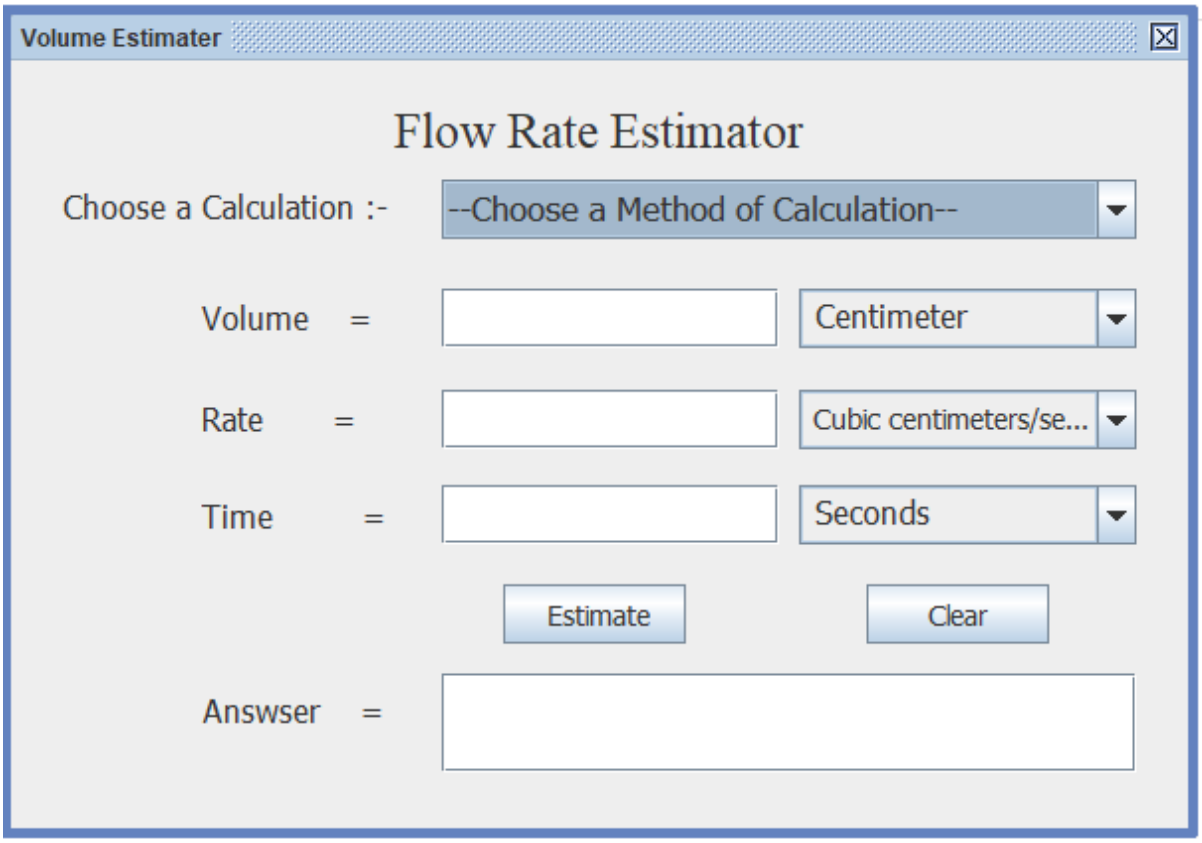


3. Flow Rate Estimator

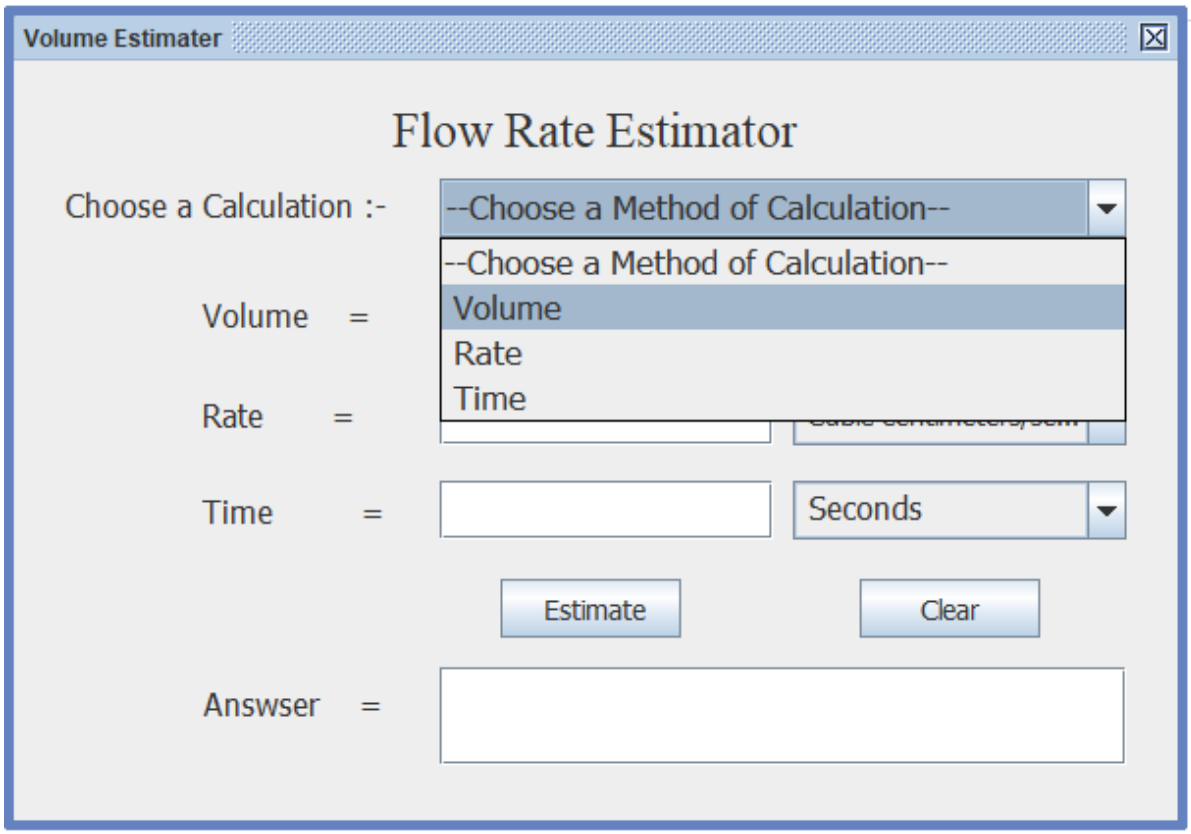
3.1 Run the Application and Flow Rate Estimator



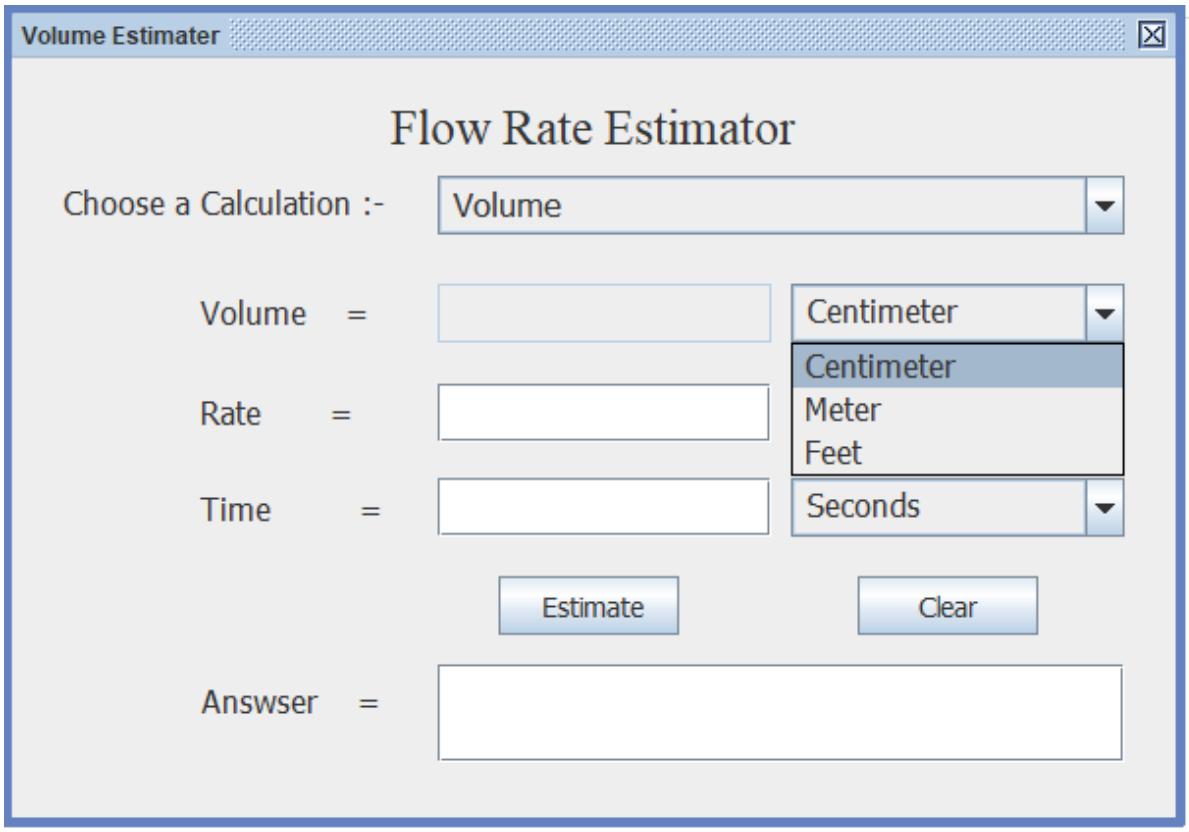
3.2 Flow Rate UI will be displayed



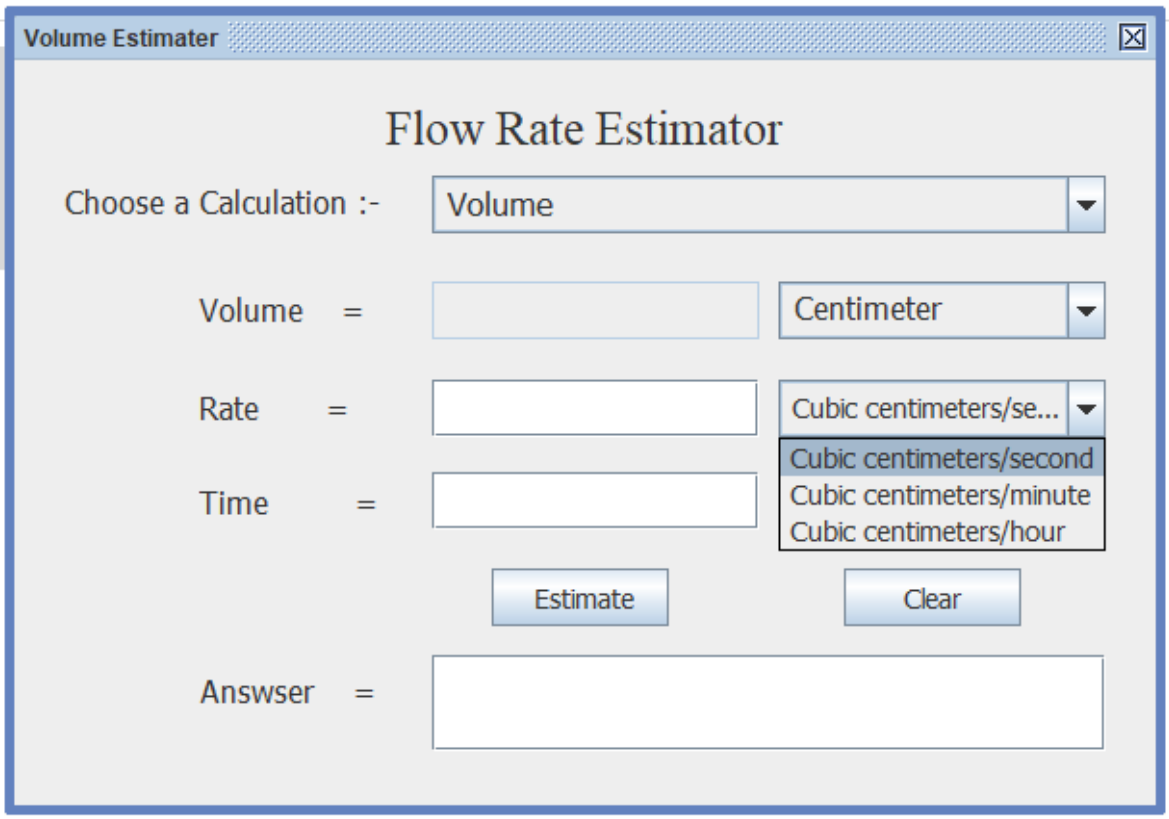
3.3 Choose the calculation method



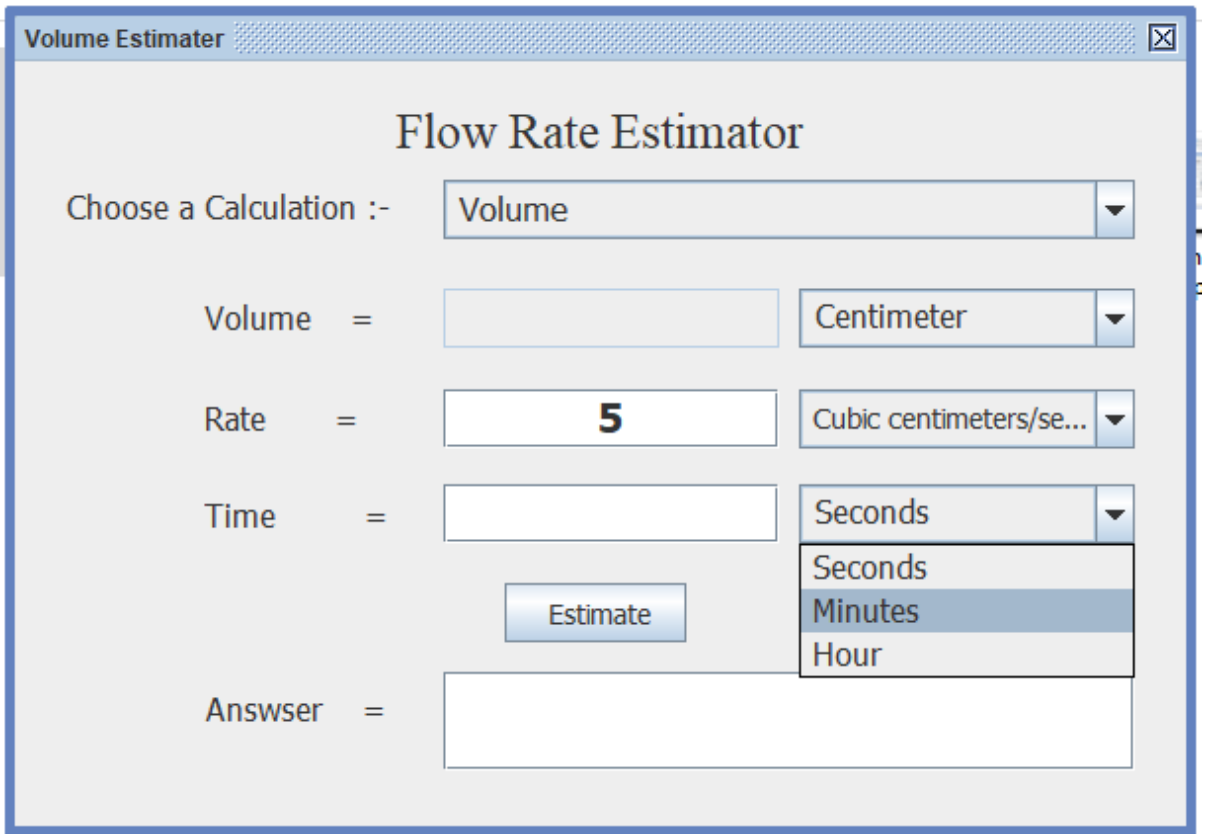
3.4 Select the Output Volume Unit



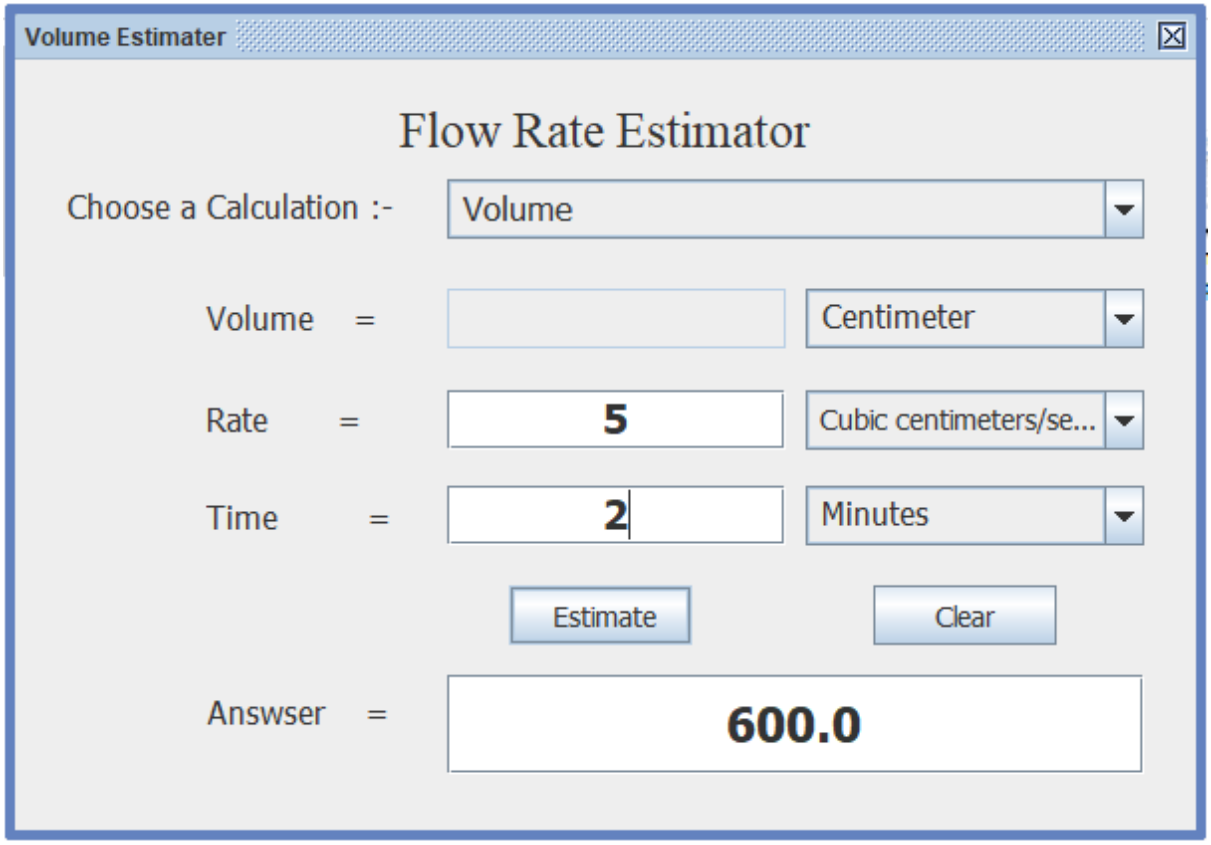
3.5 Input the Rate value and Select the Rate Option



3.6 Input the Time value and Select the Time Option

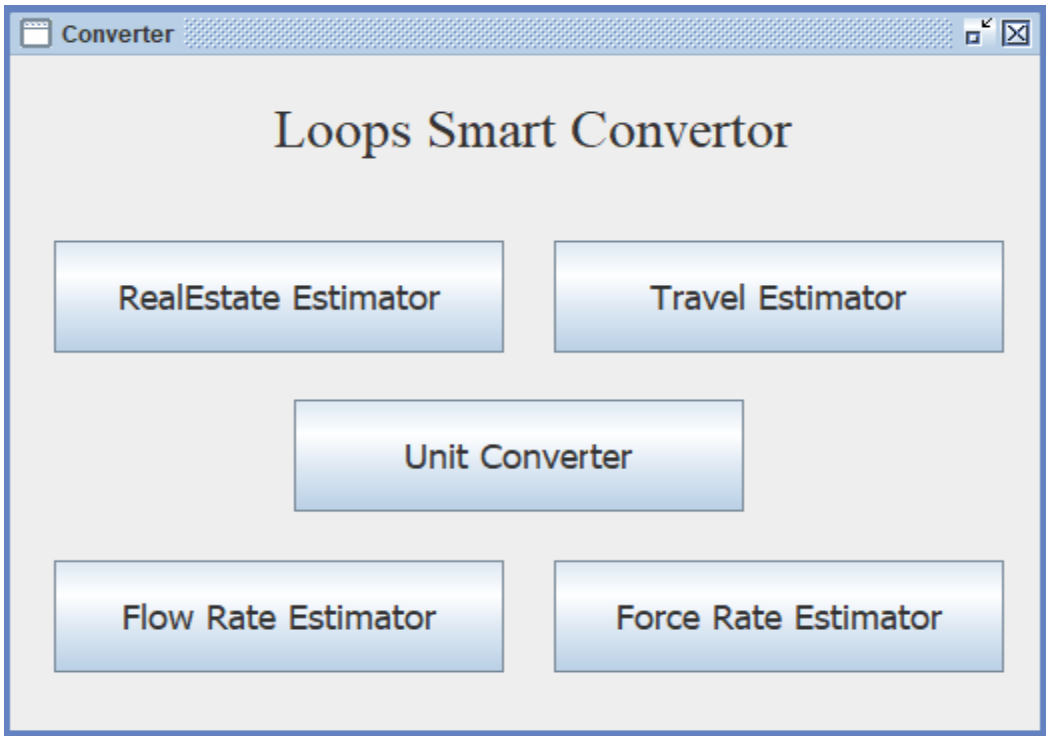


3.7 Display the Output

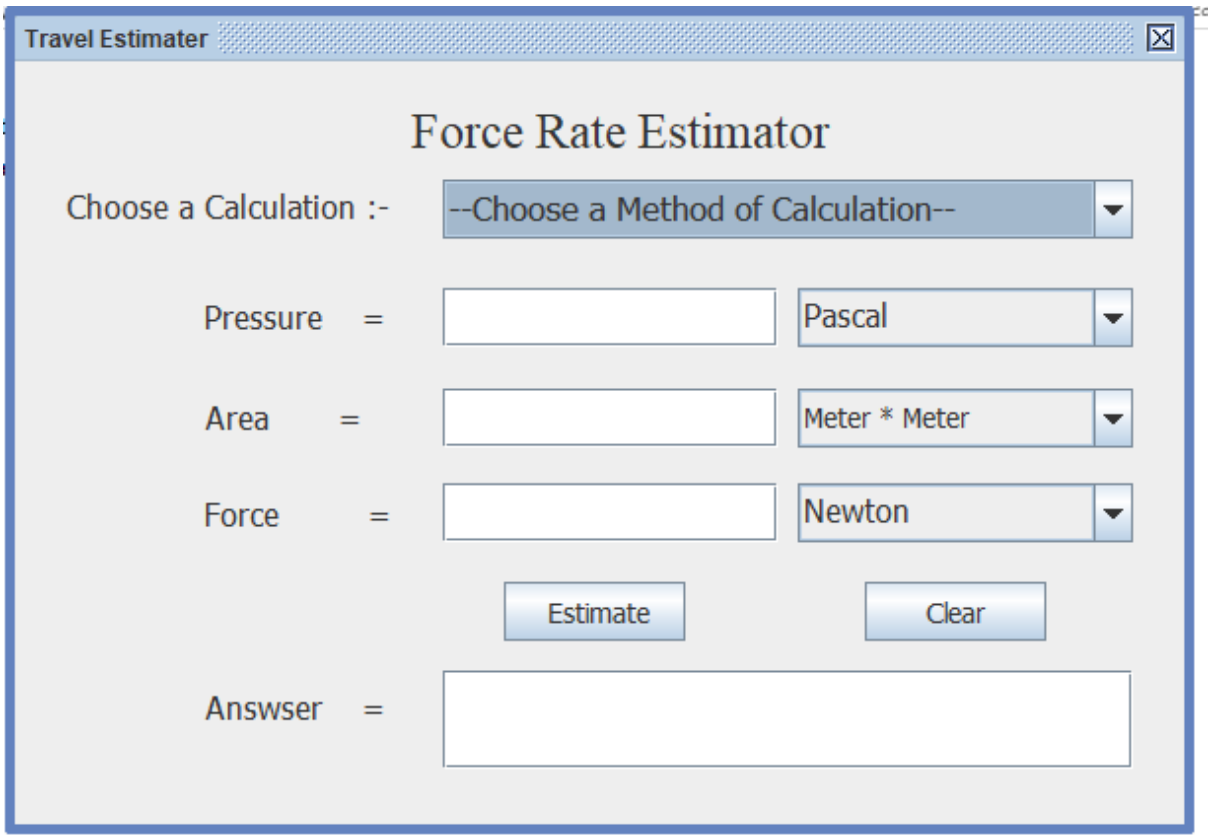


4. Force Rate Estimator

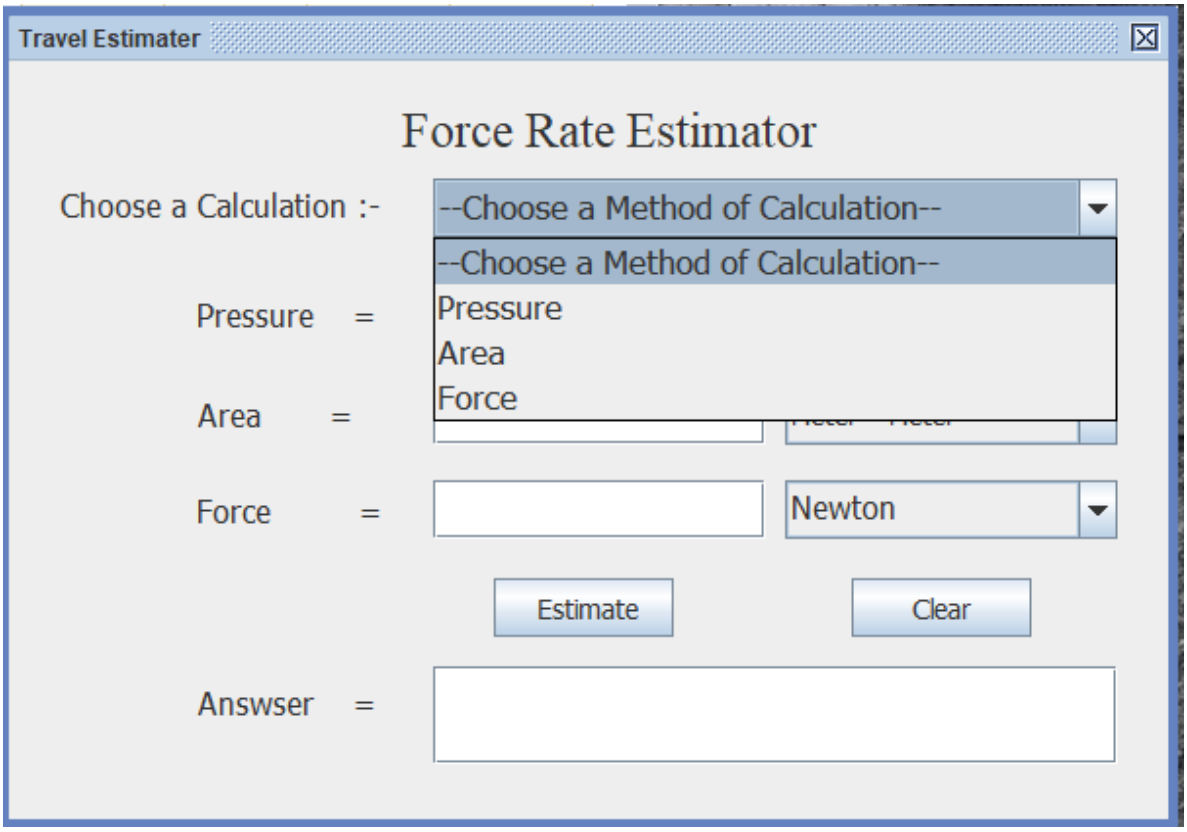
4.1 Run the Application and Force Rate Estimator



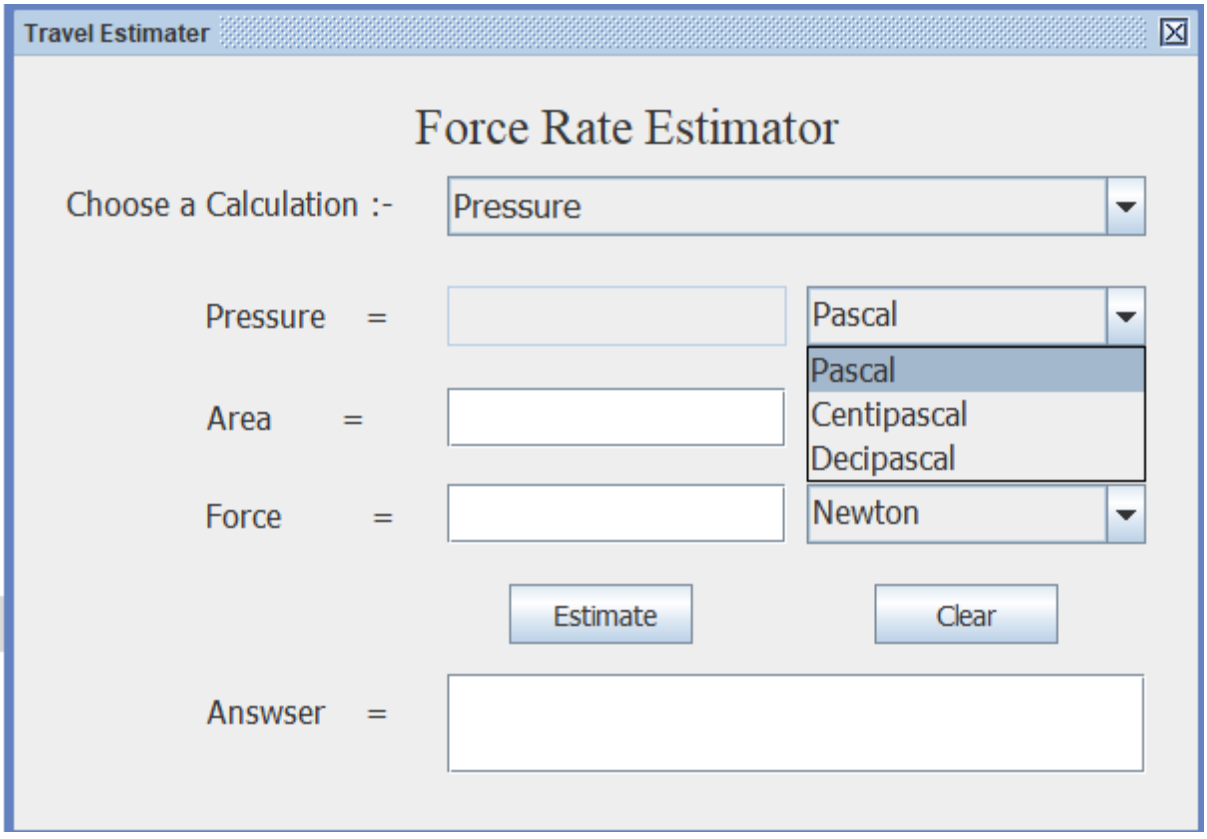
4.2 Force Rate UI will be displayed



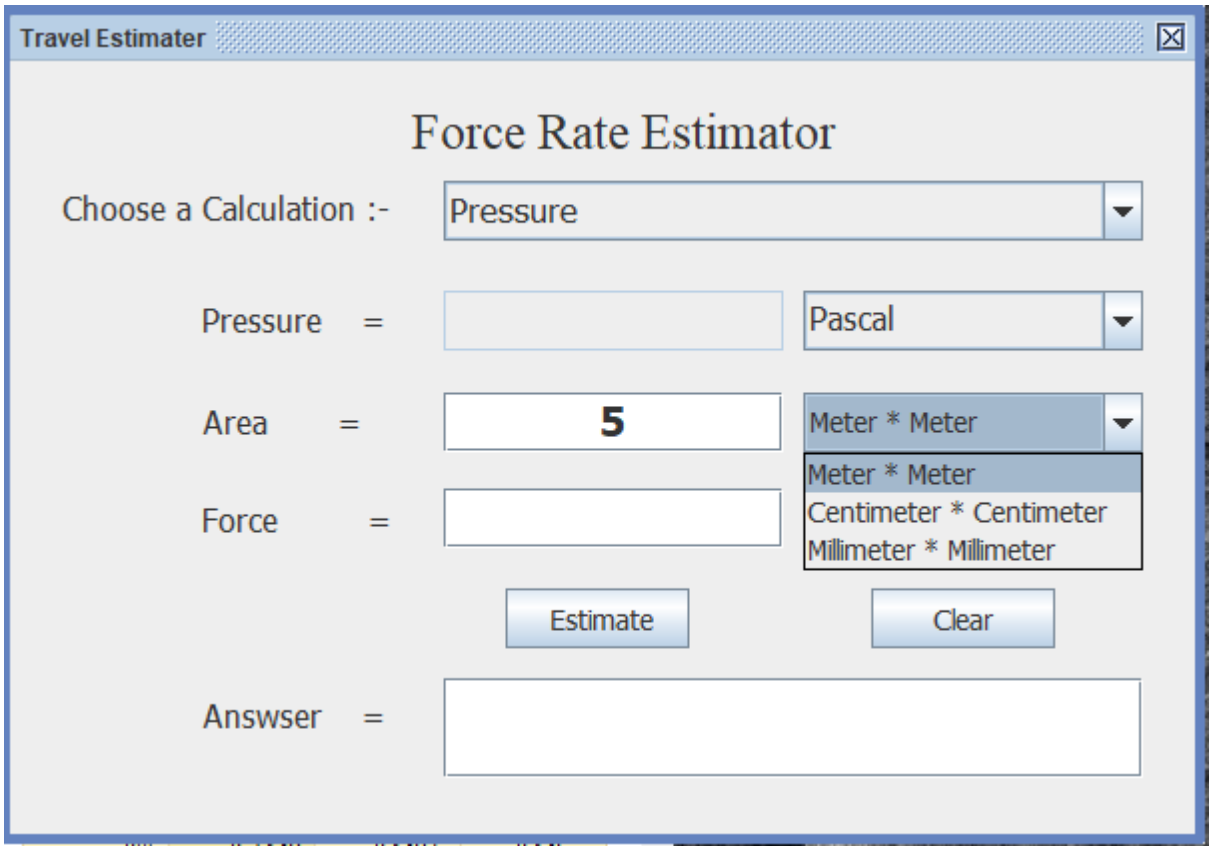
4.3 Choose the calculation method



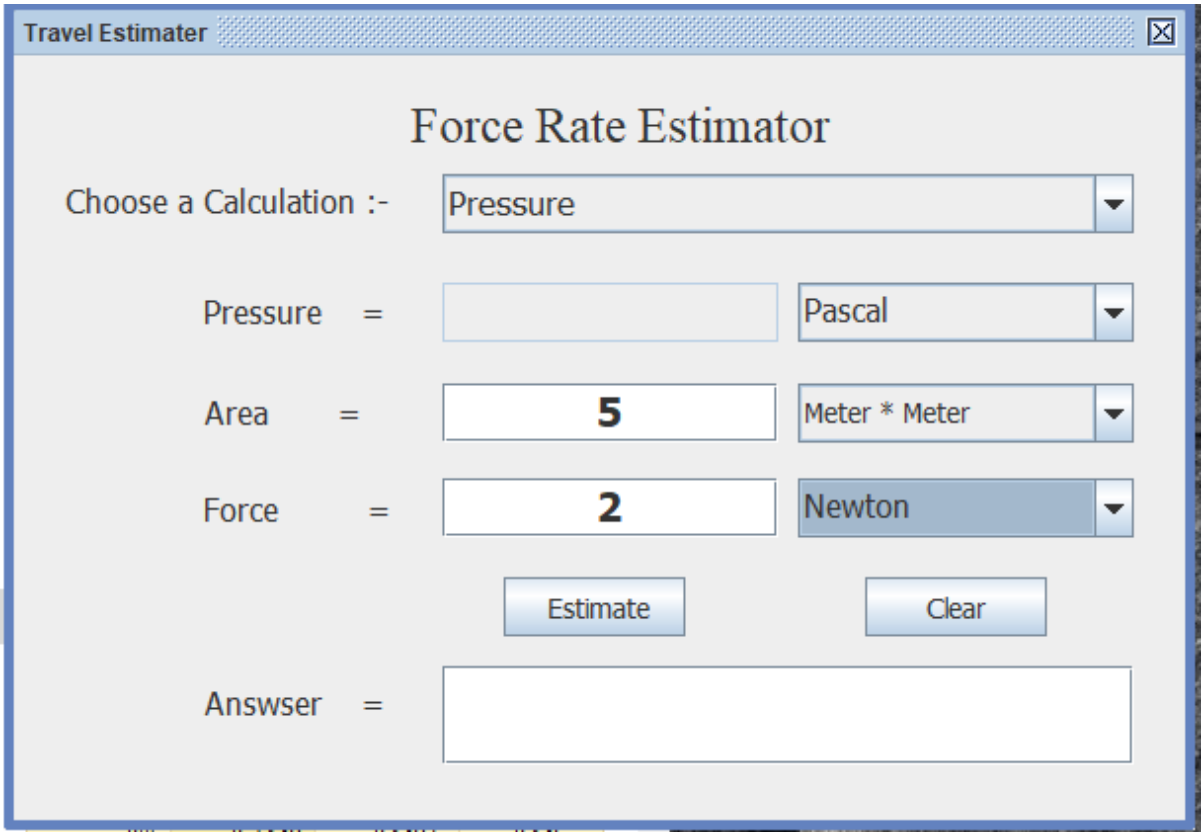
4.4 Select the Output Pressure Unit



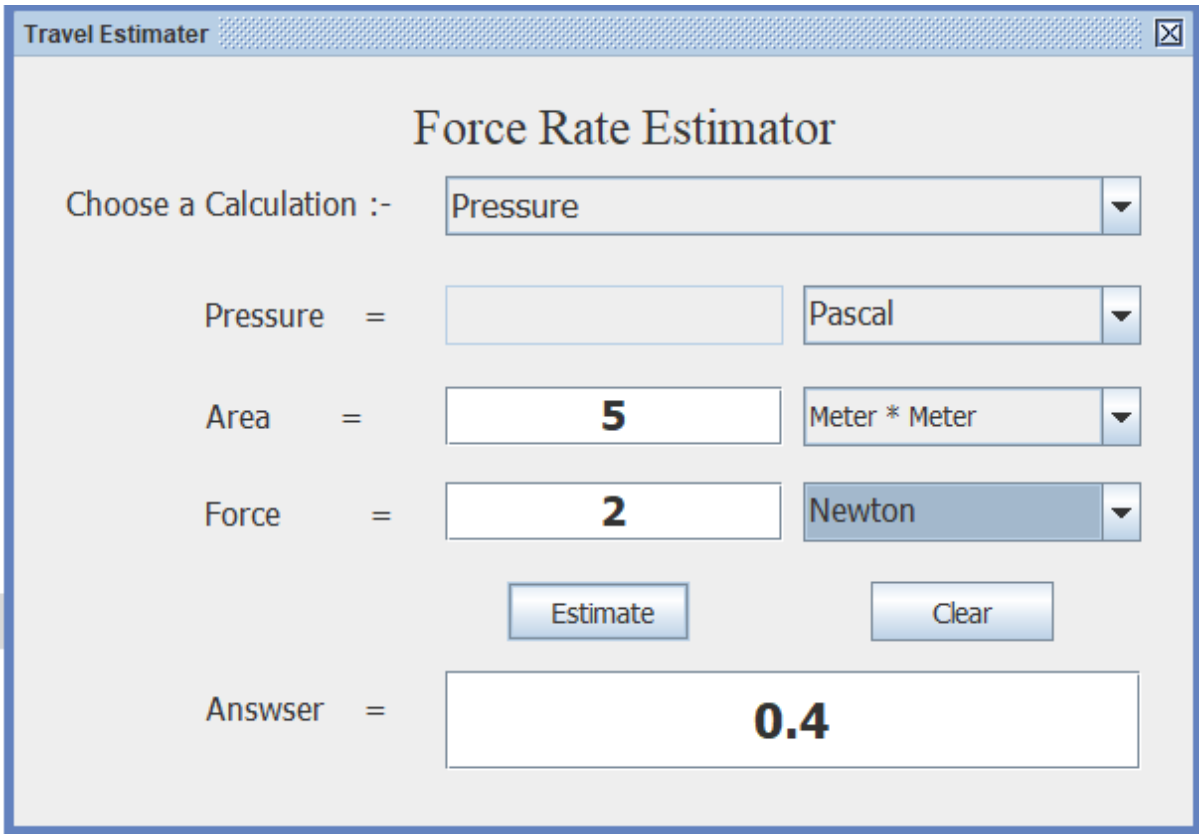
4.5 Input the Area Size and Select the Area Option



3.6 Input the Force value and Select the Force Option

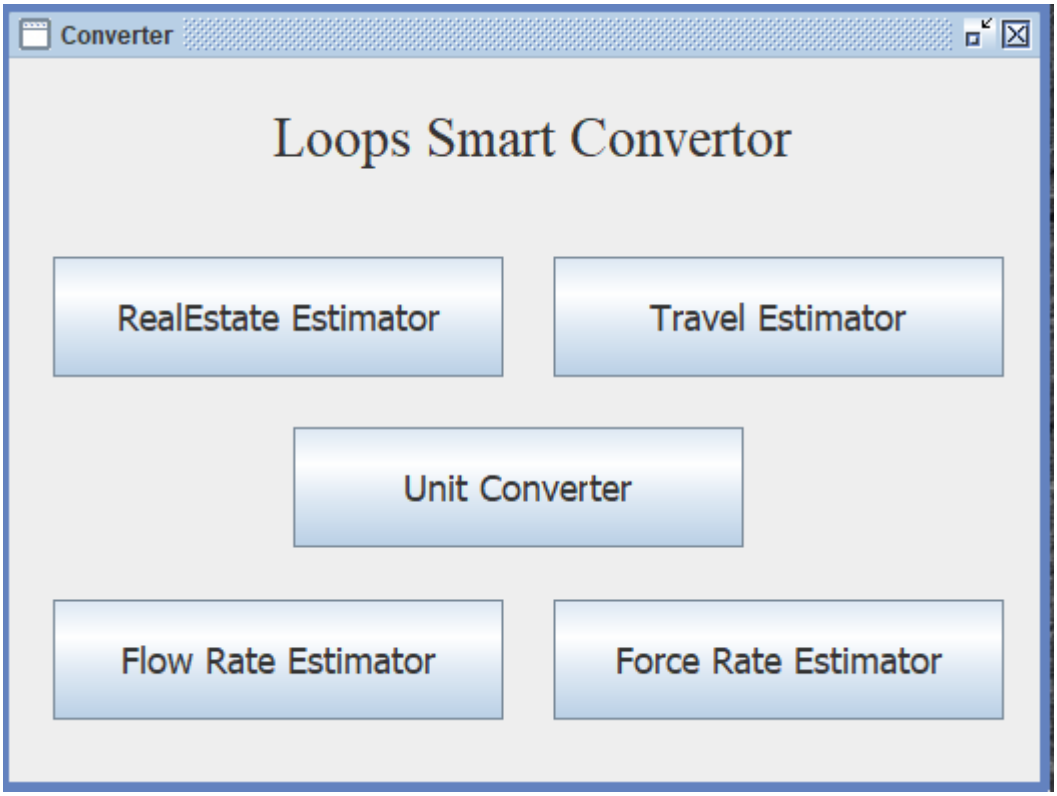


4.7 Display the Output

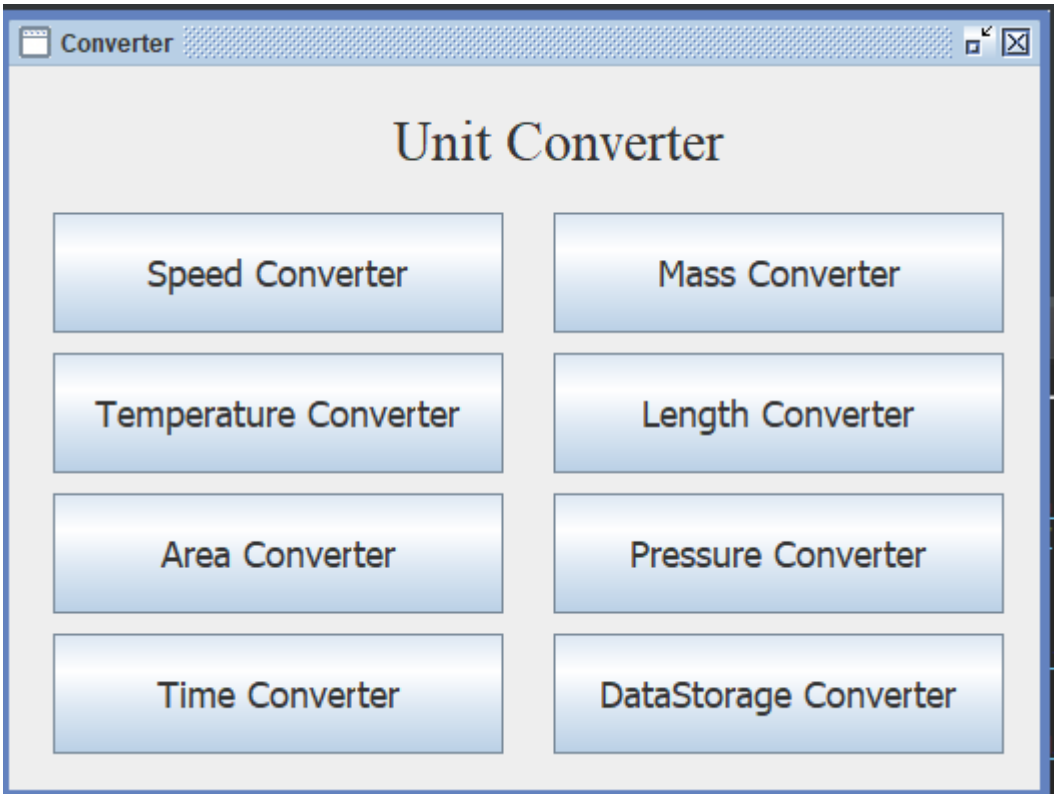


5. Unit Converter

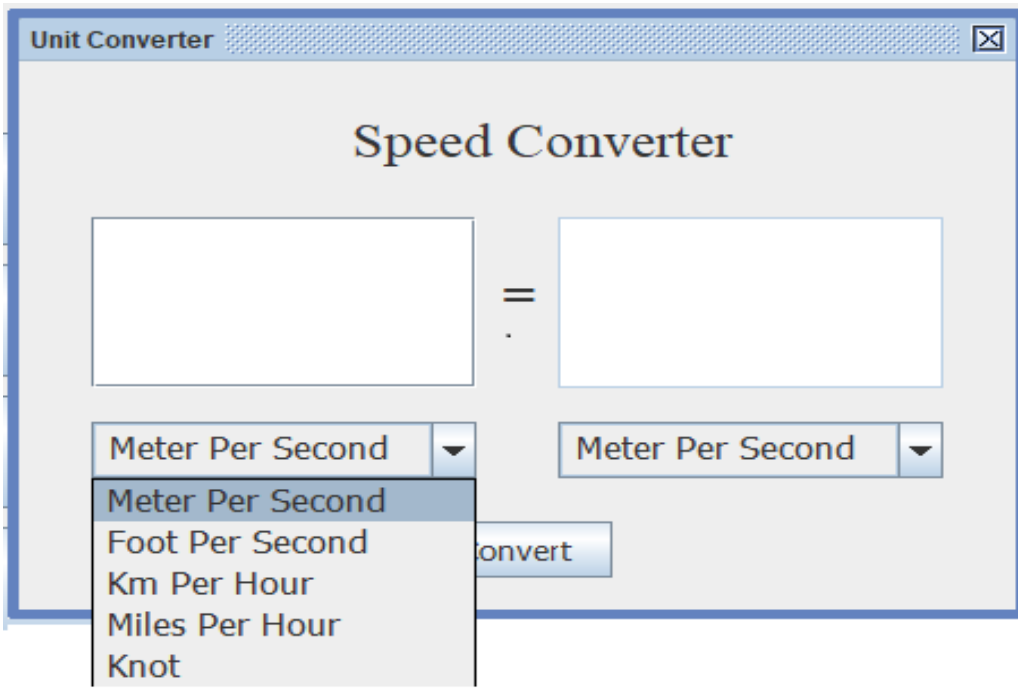
5.1 Run the Application and Unit Convertor



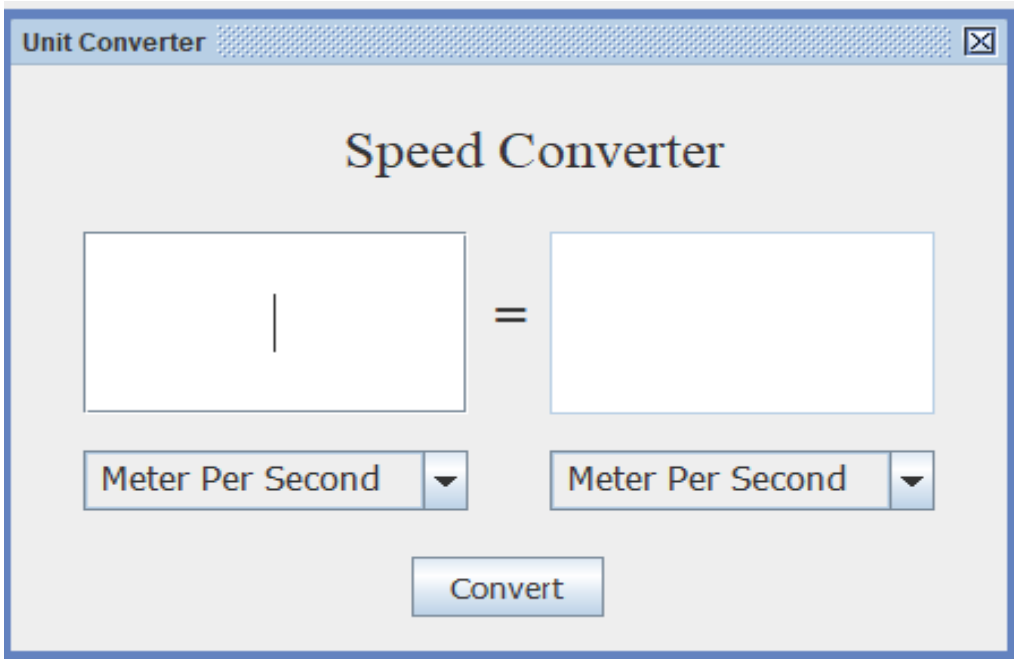
5.2 Select anyone of the unit converter (e.g.:- Speed Converter)



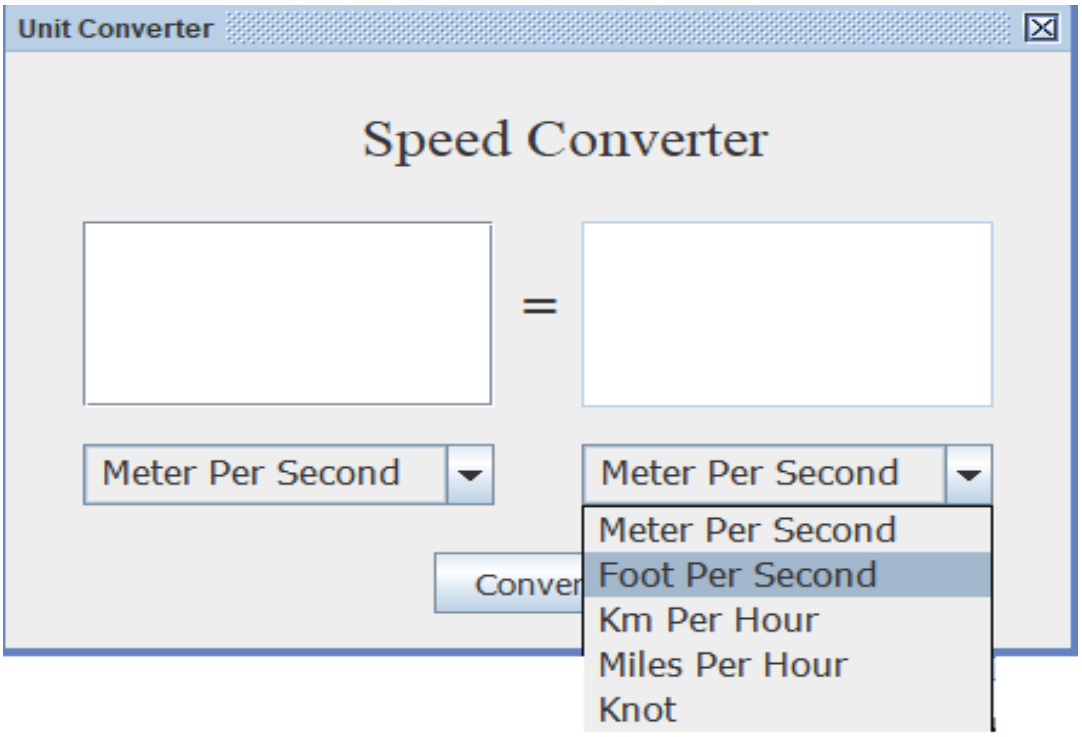
5.3 Select the input conversion scale



5.4 Input the Value that to be converted



5.5 Select the output conversion scale



5.6 Display the Output