tutorial

Windows App SDK

Clock Control

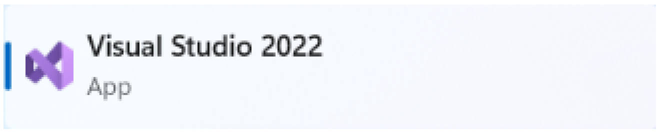
Clock Control

Clock Control shows how to create a **Control** that can be used as a **Clock** using **Windows App SDK**

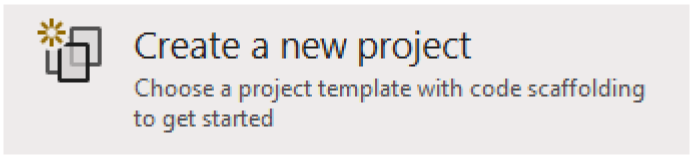
Step 1

Follow **Setup and Start** on how to get **Setup** and **Install** what you need for **Visual Studio 2022** and **Windows App SDK**.

In **Windows 11** choose **Start** and then find or search for **Visual Studio 2022** and then select it.

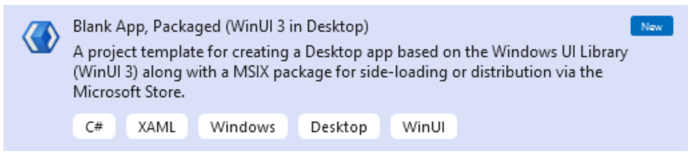


Once **Visual Studio 2022** has started select **Create a new project**.


Create a new project

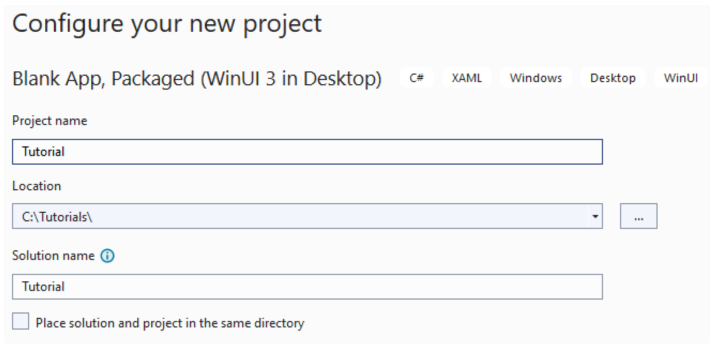
Choose a project template with code scaffolding to get started

Then choose the **Blank App, Packages (WinUI in Desktop)** and then select **Next**.


Blank App, Packaged (WinUI 3 in Desktop)

A project template for creating a Desktop app based on the Windows UI Library (WinUI 3) along with a MSIX package for side-loading or distribution via the Microsoft Store.

After that in **Configure your new project** type in the **Project name** as *ClockControl*, then select a Location and then select **Create** to start a new **Solution**.


Configure your new project

Blank App, Packaged (WinUI 3 in Desktop)

Project name: Tutorial

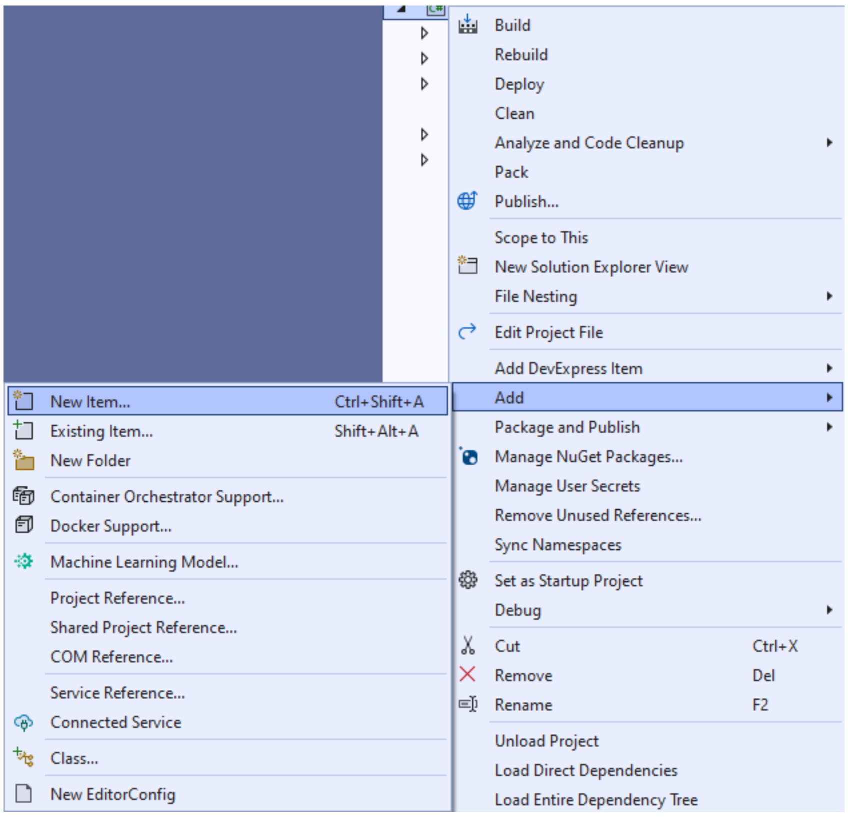
Location: C:\Tutorials\

Solution name: Tutorial

Place solution and project in the same directory

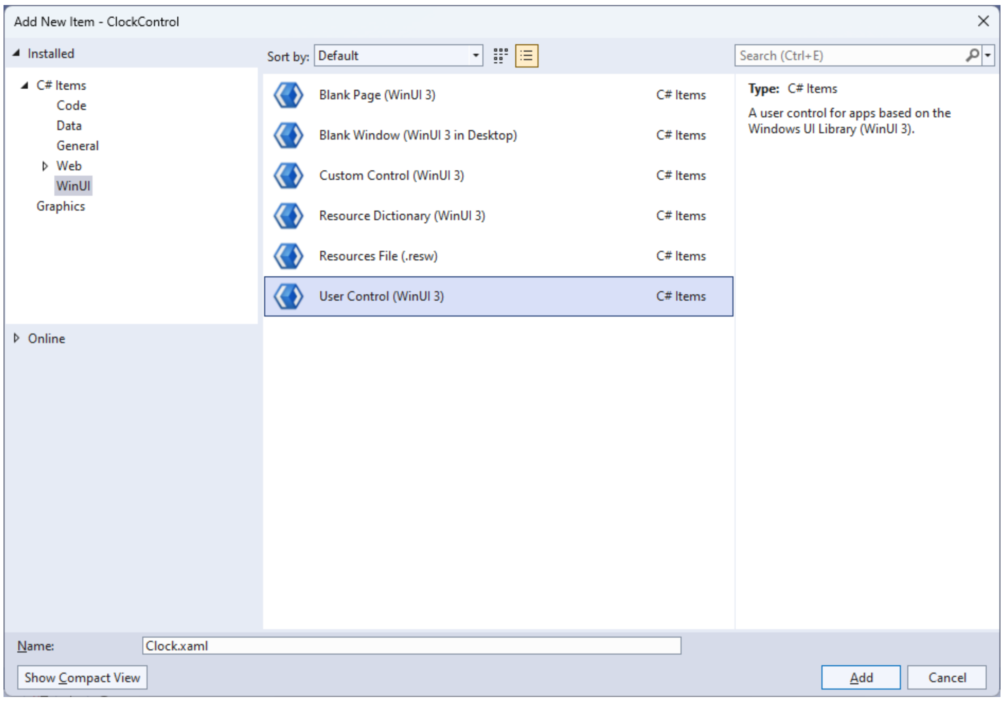
Step 2

Then in **Visual Studio** within **Solution Explorer** for the **Solution**, right click on the **Project** shown below the **Solution** and then select **Add** then **New Item…**



Step 3

Then in **Add New Item** from the **C# Items** list, select **WinUI** and then select **User Control (WinUI 3)** from the list next to this, then type in the name of *Clock.xaml* and then **Click** on **Add**.


Add New Item - ClockControl
Installed
C# Items
Code
Data
General
Web
WinUI
Graphics
Online
Search (Ctrl+E)
Blank Page (WinUI 3) C# Items
Blank Window (WinUI 3 in Desktop) C# Items
Custom Control (WinUI 3) C# Items
Resource Dictionary (WinUI 3) C# Items
Resources File (.resw) C# Items
User Control (WinUI 3) C# Items
Show Compact View
Add
Cancel

Sort by: Default

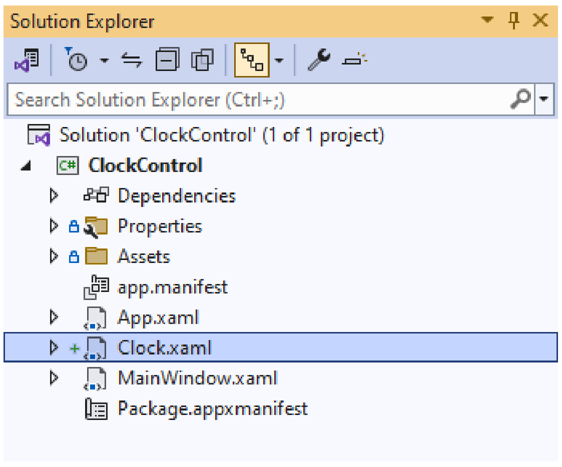
Type: C# Items

A user control for apps based on the Windows UI Library (WinUI 3).

Name: Clock.xaml

Step 4

Then from **Solution Explorer** for the **Solution** double-click on **Clock.xaml** to see the **XAML** for the **User Control**.



Step 5

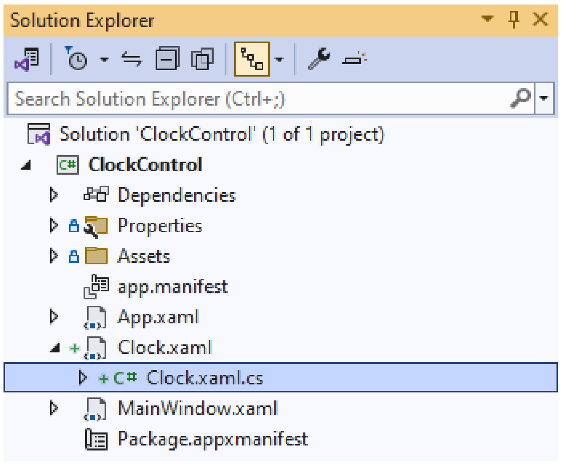
In the **XAML** for *Clock.xaml* there be some **XAML** for a **`Grid`**, above **`</Grid>`**, type in the following **XAML**:

```
<Viewbox>
    <Canvas Name="Display" Height="300" Width="300" Loaded="Load"/>
</Viewbox>
```

This **XAML** contains a **`Viewbox`** which will **Scale** a **`Canvas`** with a **Loaded** event handler of **Load**.

Step 6

Then, within **Solution Explorer** for the **Solution** select the arrow next to **Clock.xaml** then double-click on **Clock.xaml.cs** to see the **Code** for the **User Control**.



Step 7

You will now be in the **View** for the **Code** of *Clock.xaml.cs*, near the top of the **Code**, below the final **`using`** statement you will need to type the following **`using`** statement:

```
using Microsoft.UI.Xaml.Shapes;
```

Step 8

Then, while still in the **View** for the **Code** of *Clock.xaml.cs*, type in the following **Code** below the end of the **Constructor** of **`public Clock() { ... }`**:

```
private const int seconds_width = 2;
private const int minutes_width = 4;
private const int hours_width = 8;

private readonly DispatcherTimer _timer = new();
private readonly Canvas _markers = new();
private readonly Canvas _face = new();
private double _diameter;

// Dependency Property & Properties

// Transform Method

// Markers Method

// Hand, GetHand, AddHand & RemoveHand Methods

// SecondHand, MinuteHand & HourHand Methods

// Layout & Load Methods
```

The **`class`** for **`Clock`** represents the **User Control** for the **Clock** and includes a **`DispatcherTimer`** that will be used for the time of the **Clock** along with a **`double`** for the diameter of the **Clock**.

Step 9

While still in the **class** of **Gauge** after the **Comment** of **// Dependency Property & Properties** type the following **Dependency Property** and **Properties**:

```
public static readonly DependencyProperty FillProperty =
DependencyProperty.Register(nameof(Fill), typeof(Brush),
typeof(Clock), null);

public Brush Fill
{
    get { return (Brush)GetValue(FillProperty); }
    set { SetValue(FillProperty, value); }
}

public bool IsRealTime { get; set; } = true;
public bool ShowSeconds { get; set; } = true;
public bool ShowMinutes { get; set; } = true;
public bool ShowHours { get; set; } = true;
public DateTime Time { get; set; } = DateTime.Now;

public bool Enabled
{
    get { return _timer.IsEnabled; }
    set
    {
        if (_timer.IsEnabled)
        {
            _timer.Stop();
        }
        else
        {
            _timer.Start();
        }
    }
}
```

The **Dependency Property** will be used for elements of the **Clock** that will use the **Property** of **Fill** and the other **Properties** configure aspects of the **Clock** including which hands to show and if the **Clock** is **Enabled** or not.

Step 10

While still in the **`class`** of **`Clock`** after the **Comment** of **`// Transform Method`** type the following **Method**:

```
private TransformGroup Transform(double angle, double x, double y)
{
    var transformGroup = new TransformGroup();
    var firstTranslate = new TranslateTransform()
    {
        X = x,
        Y = y
    };
    transformGroup.Children.Add(firstTranslate);
    var rotateTransform = new RotateTransform()
    {
        Angle = angle
    };
    transformGroup.Children.Add(rotateTransform);
    var secondTranslate = new TranslateTransform()
    {
        X = _diameter / 2,
        Y = _diameter / 2
    };
    transformGroup.Children.Add(secondTranslate);
    return transformGroup;
}
```

This **Method** will create a **`TransformGroup`** to rotate elements to be used on the **Clock**.

Step 11

While still in the **`class`** of **`Clock`** after the **Comment** of **`// Markers Method`** type the following **Method**:

```
private void Markers(Canvas canvas, double thickness)
{
    double inner = _diameter - 15;
    _markers.Children.Clear();
    _markers.Width = inner;
    _markers.Height = inner;
    for (int i = 0; i < 60; i++)
    {
        var marker = new Rectangle
        {
            Fill = Foreground
        };
        if ((i % 5) == 0)
        {
            marker.Width = 3;
            marker.Height = 8;
            marker.RenderTransform = Transform(i * 6, -(marker.Width / 2),
            -(marker.Height * 2 + 4.5 - thickness / 2 - inner / 2 - 6));
        }
        else
        {
            marker.Width = 1;
            marker.Height = 4;
            marker.RenderTransform = Transform(i * 6, -(marker.Width / 2),
            -(marker.Height * 2 + 12.75 - thickness / 2 - inner / 2 - 8));
        }
        _markers.Children.Add(marker);
    }
    canvas.Children.Add(_markers);
}
```

This **Method** will create the set of small and large markers to be displayed on the **Clock**.

Step 12

While still in the **class** of **Clock** after the **Comment** of **// Hand, GetHand, AddHand & Remove Hand Methods** type the following **Methods**:

```
private Rectangle Hand(double width, double height) => new()
{
    Width = width,
    Height = height,
    Fill = Fill,
    RadiusX = width / 2,
    RadiusY = width / 2,
    Name = width.ToString()
};

private Rectangle GetHand(int width) =>
    FindName(width.ToString()) as Rectangle;

private Rectangle AddHand(int width, int height)
{
    var hand = GetHand(width);
    if (hand == null)
    {
        hand = Hand(width, height);
        _face.Children.Add(hand);
    }
    return hand;
}

private void RemoveHand(int width)
{
    var hand = GetHand(width);
    if (hand != null)
    {
        _face.Children.Remove(hand);
    }
}
```

Hand will be used to create the hands for the **Clock** and will take advantage of the different widths to tell them apart in the next **Methods** of **AddHand,** which will put the hands on the **Clock** and **RemoveHand** which will remove any hands.

Step 13

While still in the **`class`** of **`Clock`** after the **Comment** of **`// SecondHand, MinuteHand & HourHand Methods`** type the following **Methods**:

```
private void SecondHand(int seconds)
{
    if (ShowSeconds)
    {
        var secondsHeight = (int)_diameter / 2 - 20;
        var secondsHand = AddHand(seconds_width, secondsHeight);
        secondsHand.RenderTransform = Transform(seconds * 6,
            -seconds_width / 2, -secondsHeight + 4.25);
    }
    else
    {
        RemoveHand(seconds_width);
    }
}

private void MinuteHand(int minutes, int seconds)
{
    if (ShowMinutes)
    {
        var minutesHeight = (int)_diameter / 2 - 40;
        var minutesHand = AddHand(minutes_width, minutesHeight);
        minutesHand.RenderTransform = Transform(6 * minutes + seconds / 10,
            -minutes_width / 2, -minutesHeight + 4.25);
    }
    else
    {
        RemoveHand(minutes_width);
    }
}

private void HourHand(int hours, int minutes, int seconds)
{
    if (ShowHours)
    {
        var hoursHeight = (int)_diameter / 2 - 60;
        var hoursHand = AddHand(hours_width, hoursHeight);
        hoursHand.RenderTransform = Transform(
            30 * hours + minutes / 2 + seconds / 120,
            -hours_width / 2, -hoursHeight + 4.25);
    }
    else
    {
        RemoveHand(hours_width);
    }
}
```

These **Methods** will manage the display and movement of the three hands of the **Clock** for seconds, minutes and hours.

Step 14

While still in the **`class`** of **`Clock`** after the **Comment** of **`// Layout & Load Methods`** type the following **Methods**:

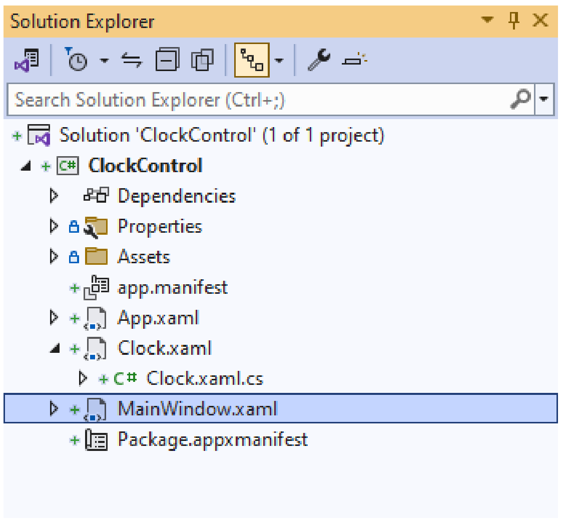
```
private void Layout(Canvas canvas)
{
    canvas.Children.Clear();
    _diameter = canvas.Width;
    var rim = new Ellipse
    {
        Height = _diameter,
        Width = _diameter,
        Stroke = Fill,
        StrokeThickness = 20
    };
    canvas.Children.Add(rim);
    Markers(canvas, rim.StrokeThickness);
    _face.Width = _diameter;
    _face.Height = _diameter;
    canvas.Children.Add(_face);
}

private void Load(object sender, RoutedEventArgs e)
{
    Layout(Display);
    _timer.Interval = TimeSpan.FromSeconds(1);
    _timer.Tick += (object s, object obj) =>
    {
        if (IsRealTime)
        {
            Time = DateTime.Now;
        }
        SecondHand(Time.Second);
        MinuteHand(Time.Minute, Time.Second);
        HourHand(Time.Hour, Time.Minute, Time.Second);
    };
    _timer.Start();
}
```

`Layout` will create the look-and-feel of the **Clock** and uses the **Method** for **`Markers`** and **`Load`** will be used when the **`Canvas`** of the **User Control** is loaded and setup the **`DispatcherTimer`** to allow the time to be displayed along with the hands of the **Clock**.

Step 15

Within **Solution Explorer** for the **Solution** double-click on **MainWindow.xaml** to see the **XAML** for the **Main Window**.



Step 16

In the **XAML** for **MainWindow.xaml** there be some **XAML** for a **`StackPanel`**, this should be **Removed** by removing the following:

```
<StackPanel Orientation="Horizontal"
HorizontalAlignment="Center" VerticalAlignment="Center">
    <Button x:Name="myButton" Click="myButton_Click">Click Me</Button>
</StackPanel>
```

Step 17

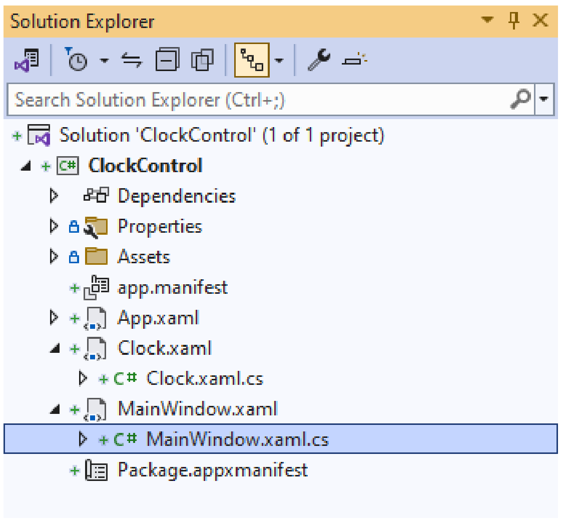
While still in the **XAML** for **MainWindow.xaml** above **`</Window>`**, type in the following **XAML**:

```
<local:Clock Margin="50" Foreground="WhiteSmoke"
    Fill="{ThemeResource SystemControlHighlightAccentBrush}"/>
```

This **XAML** contains the **User Control** of **`Clock`** with **Properties** set including **`Foreground`** and **`Fill`**.

Step 18

Then, within **Solution Explorer** for the **Solution** select the arrow next to **MainWindow.xaml** then double-click on **MainWindow.xaml.cs** to see the **Code** for the **Main Window**.



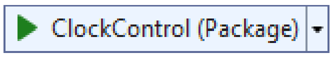
Step 19

In the **Code** for **MainWindow.xaml.cs** there be a **Method** of `myButton_Click(...)` this should be **Removed** by removing the following:

```
private void myButton_Click(object sender, RoutedEventArgs e)
{
    myButton.Content = "Clicked";
}
```

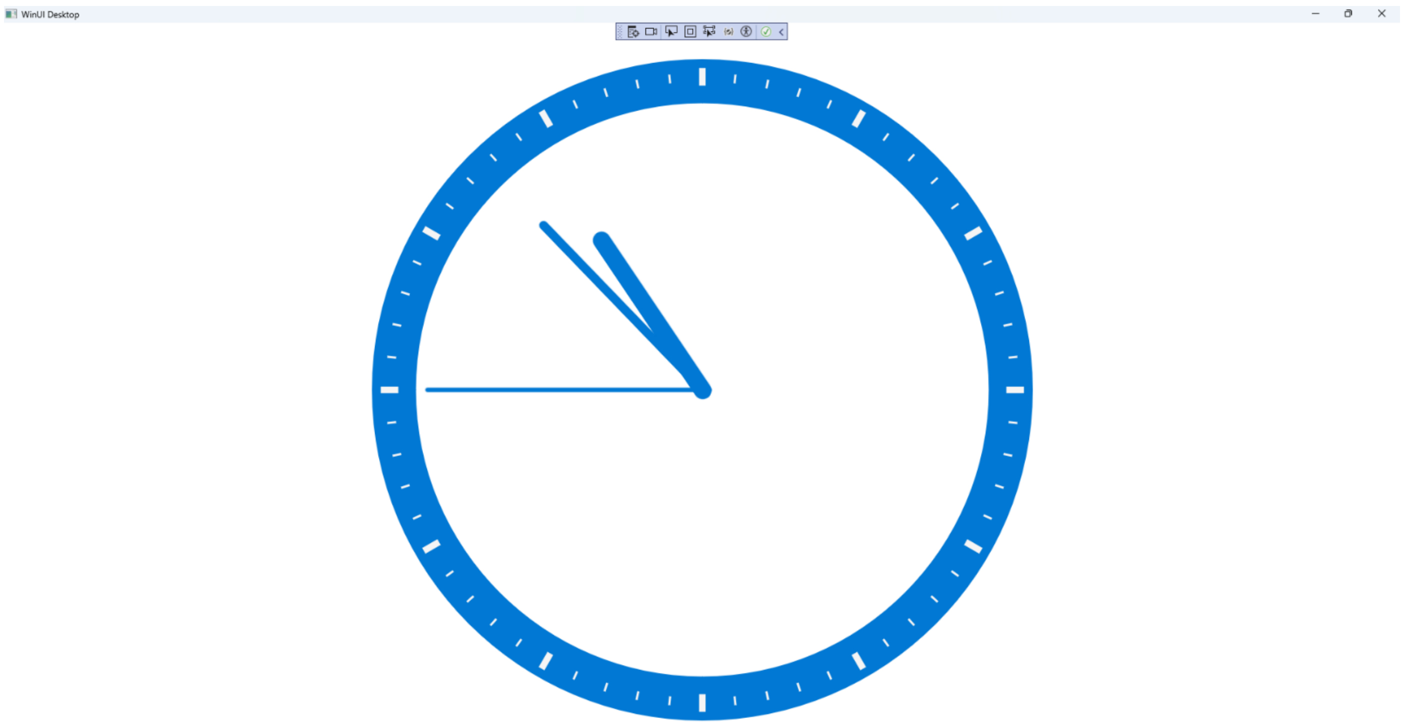
Step 20

That completes the **Windows App SDK** application. In **Visual Studio 2022** from the **Toolbar** select **ClockControl (Package)** to **Start** the application.



Step 21

Once running you will see the **Clock Control** displayed, with the current time displayed on the **Clock**.



Step 22

To **Exit** the **Windows App SDK** application, select the **Close** button from the top right of the application as that concludes this **Tutorial** for **Windows App SDK** from tutorialr.com!