



LAB 4: DEVELOPING INTERNET OF THINGS APP USING MIT APP INVENTOR 2

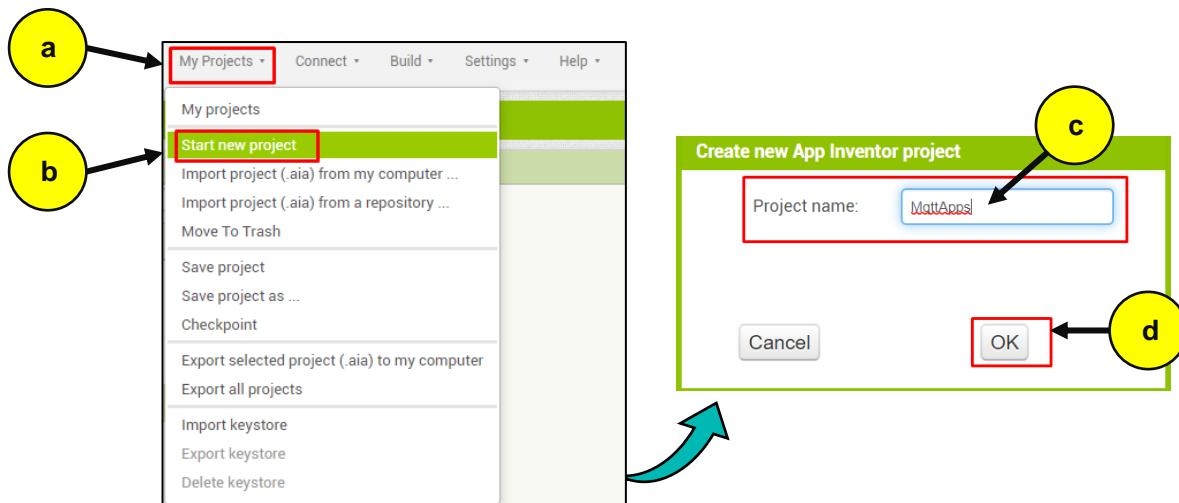
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Objective:

In this lab we are going to go through the steps of creating a MQTT apps. MQTT is the most commonly used Internet of Things Communication Protocols. We will be implementing this protocols in our apps.

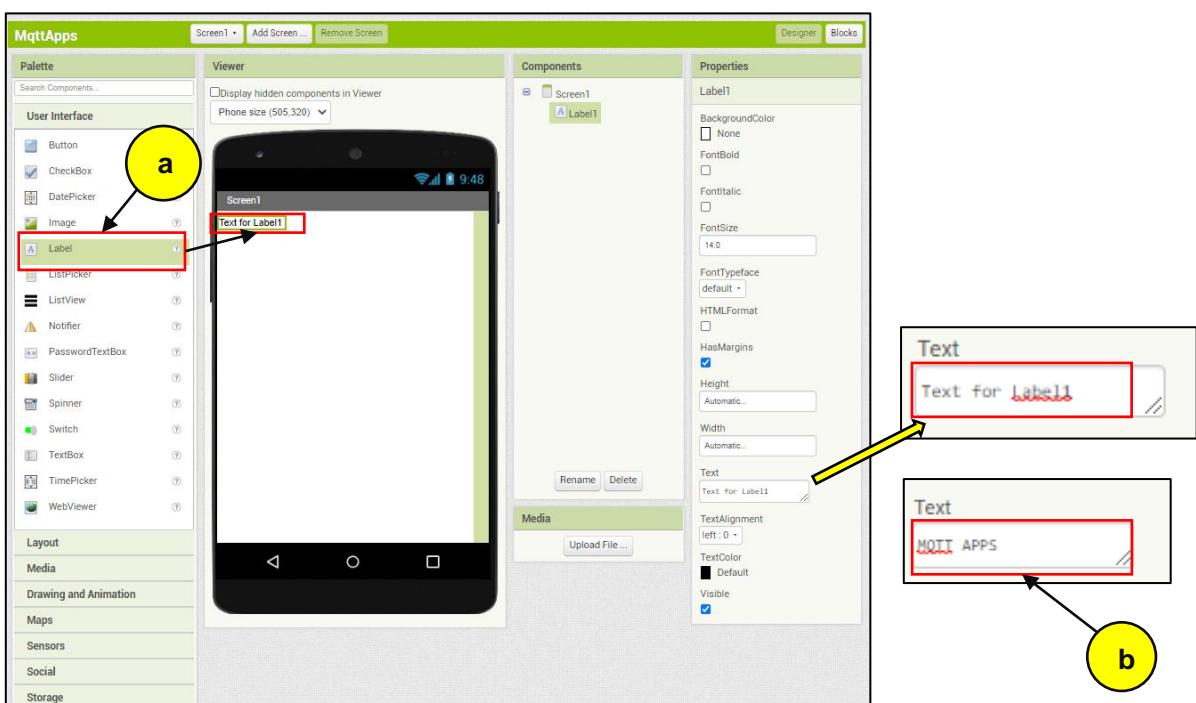
1. Create a new project

- Go to My Projects.
- Select Start new project
- A pop-up will appear. Typed in the project name as “**MqttApps**”.
- Then, click **OK**.



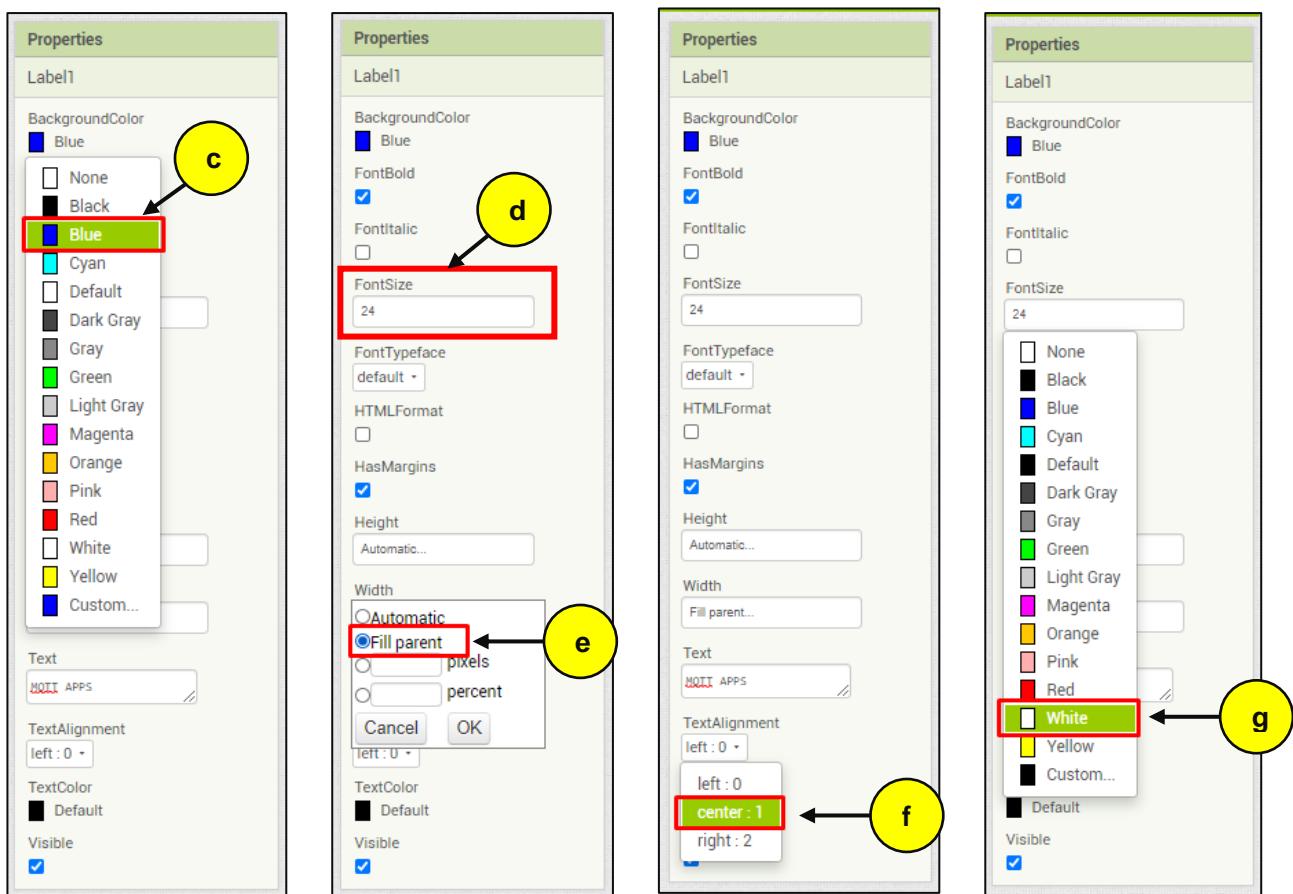
2. Designing the Broker Settings

- At the **Palette** under the **User Interface** group components, choose the **Label** and then drag and drop it onto **Screen1**
- Change text at the **Label1** from **Text for Label1** to **MQTT APPS**



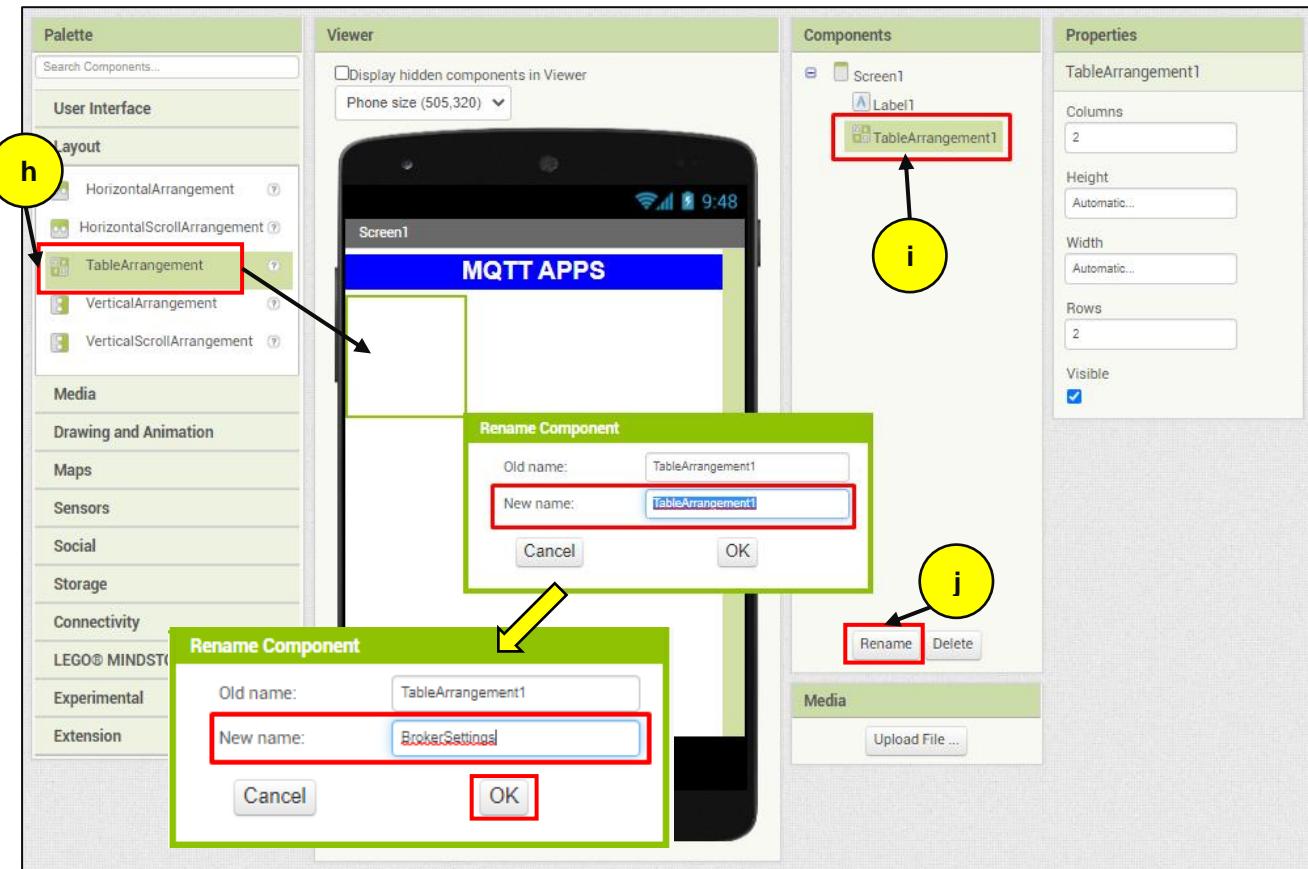
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- c. Then, change the **BackgroundColor** to **Blue**
- d. Next, change the **FontSize** to **24**.
- e. After that, change the **Width** of Label1 to **Fill parent**.
- f. To align the text at the centre of the screen, change the **TextAlignment** to **center:1**
- g. Lastly, change the **TextColor** to **White**.

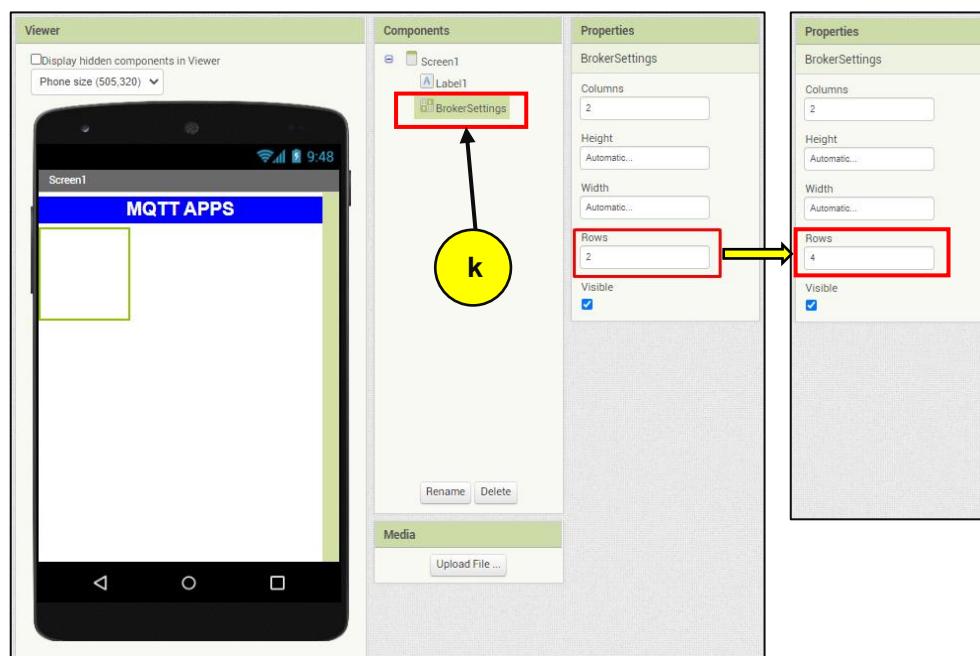


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- h. Then, go to the **Palette** and expand the **Layout** group component. Choose the **TableArrangement** layout and drag and drop it on **Screen1**
- i. Select the **TableArrangement1** at the **Components**.
- j. Click on the button **Rename** and change it to **BrokerSettings**.

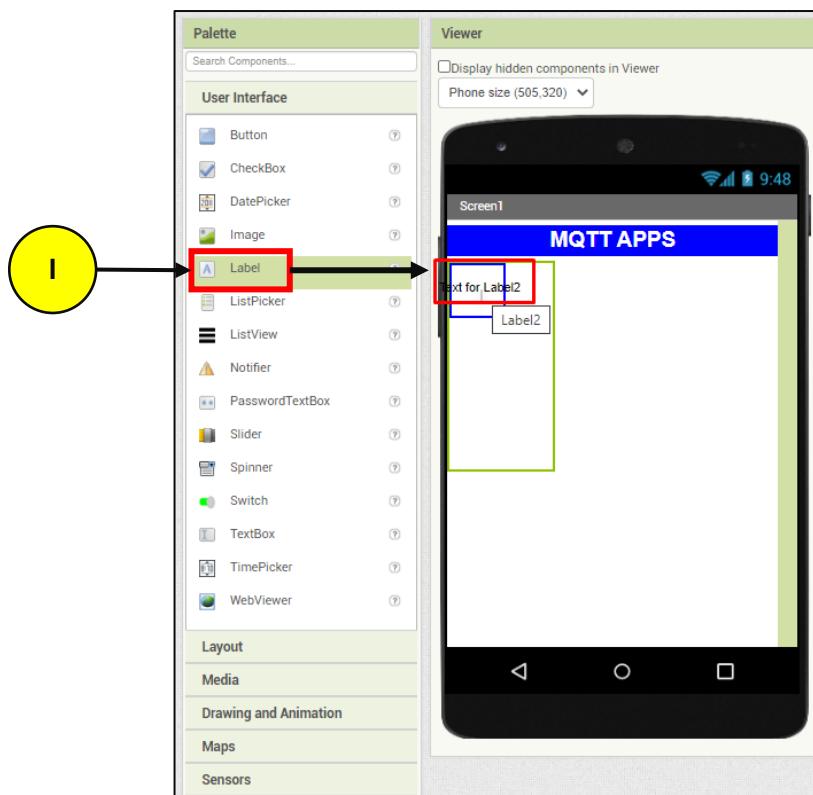


- k. After that, select the **BrokerSettings** layout at the **Components** and change the **Rows** number from **2** to **4**

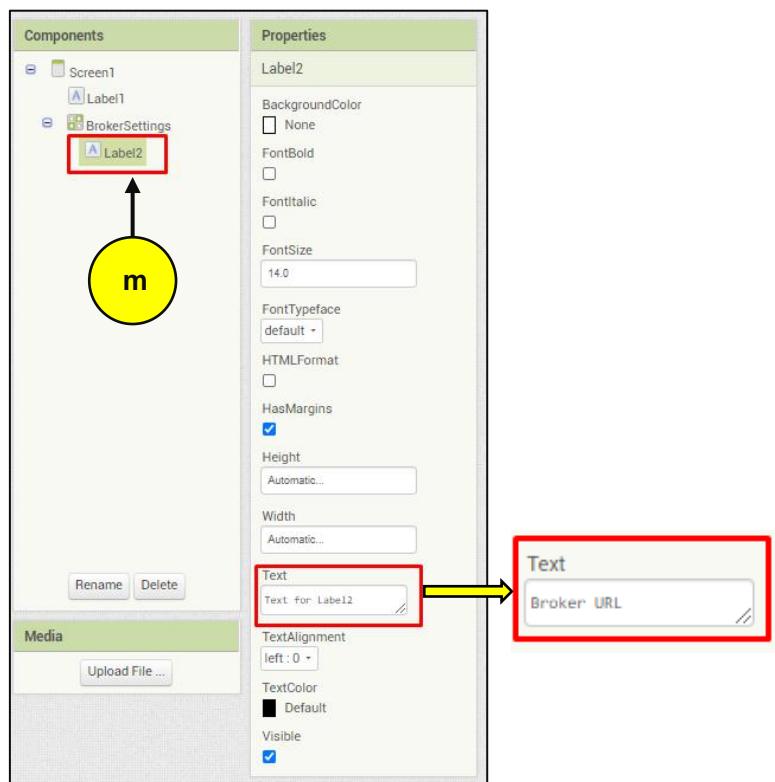


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- I. At the **Palette**, select a **Label** at the **User Interface**. Drag and drop it on the first row, first column to the **BrokerSettings** layout.

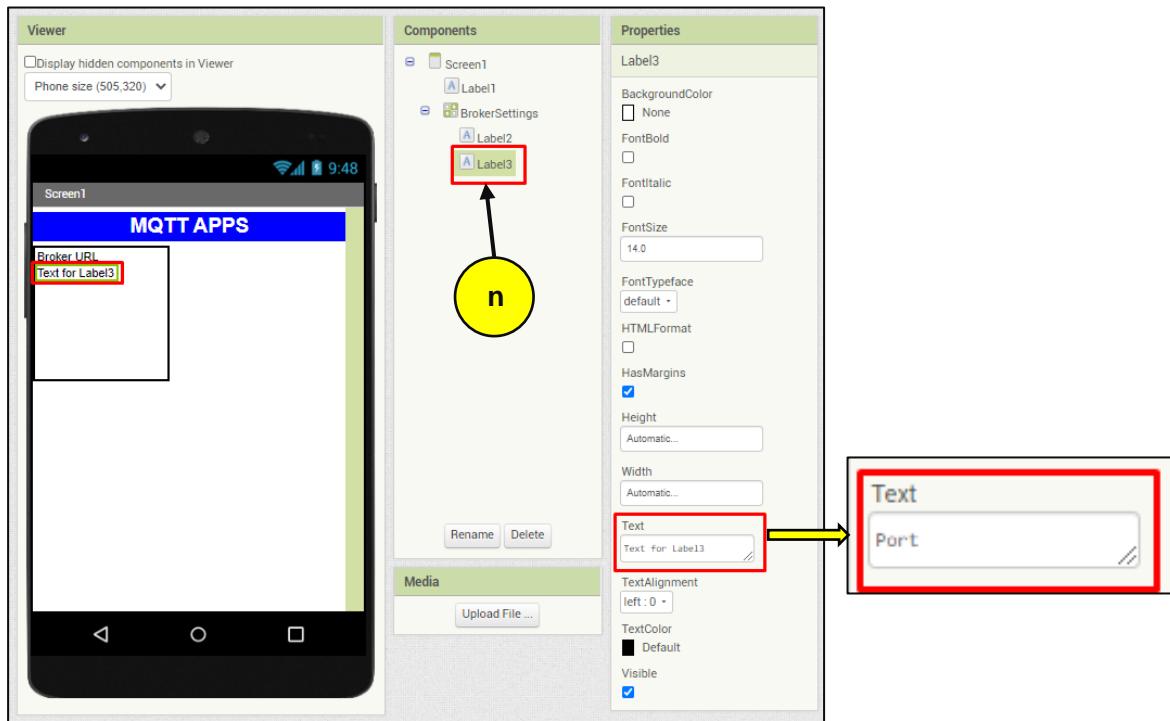


- m. Then, select the **Label2** underneath the **BrokerSettings** and change the **Text** at the **Properties** to **Broker URL**

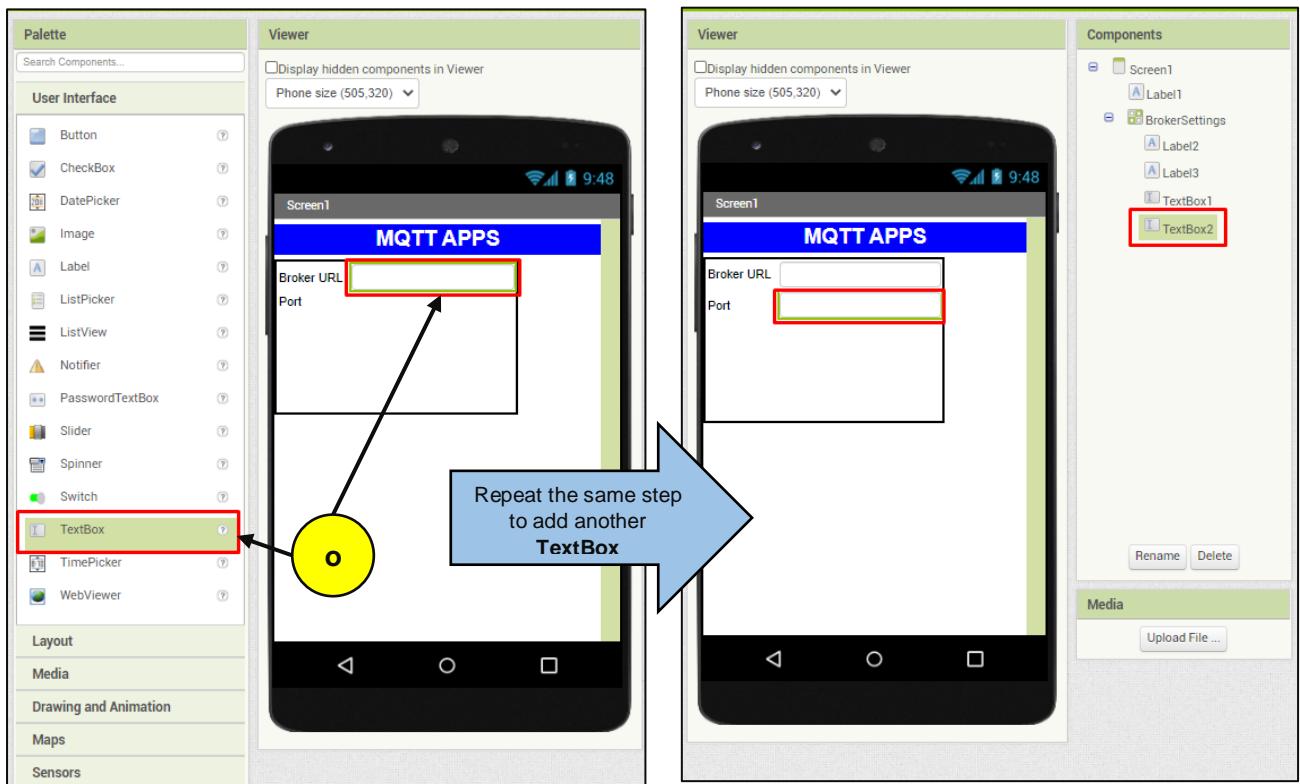


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- n. Add another **Label** underneath the Broker URL label (Drag and drop it on the second row, first column). Also, change the Text from Text for Label3 to Port. (see figure below)

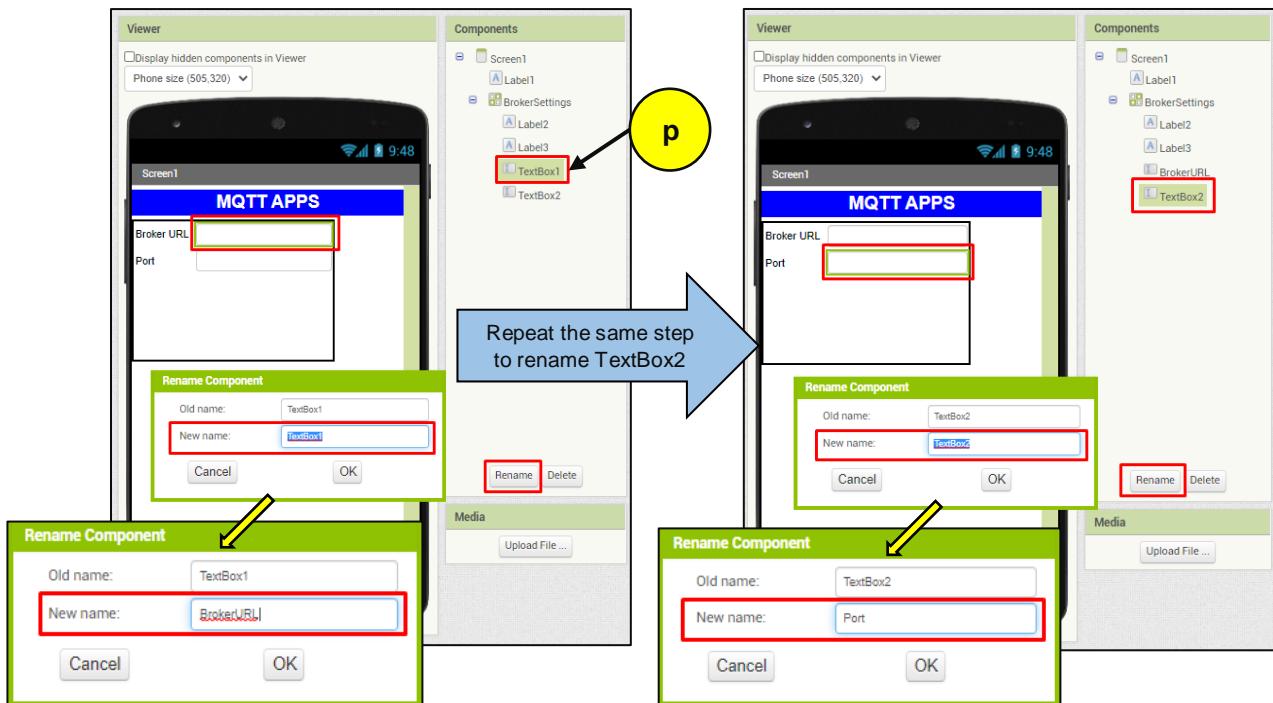


- o. Next, add a TextBox at the column next to the Broker URL label. Repeat the same steps, except this time add it to the column next to the Port label.

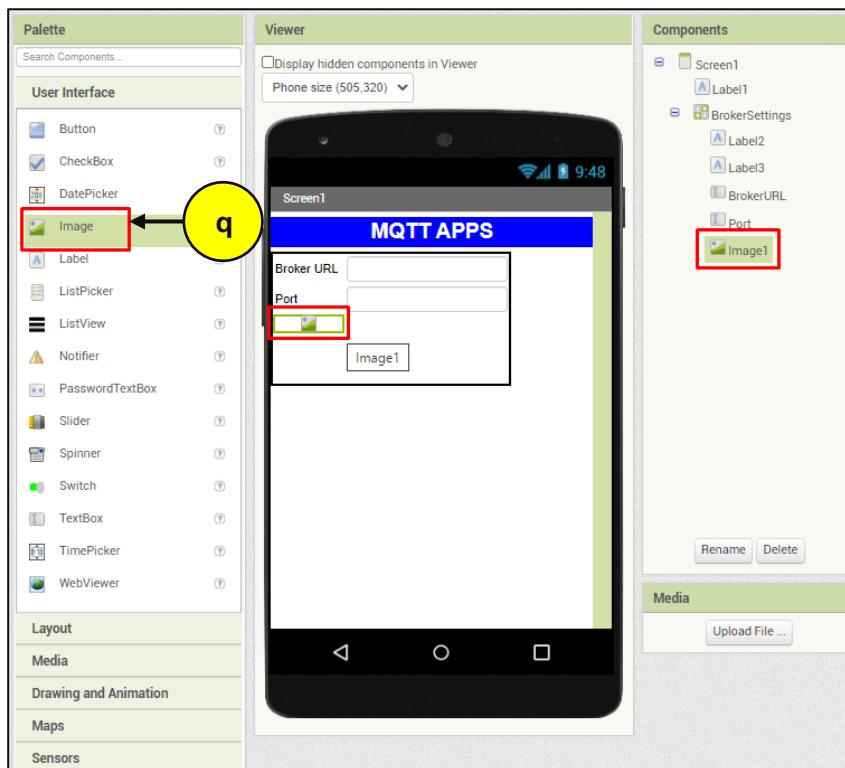


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- p. Rename the TextBox1 to BrokerURL. Repeat the same step for TextBox2 underneath it except renaming will be change to Port.

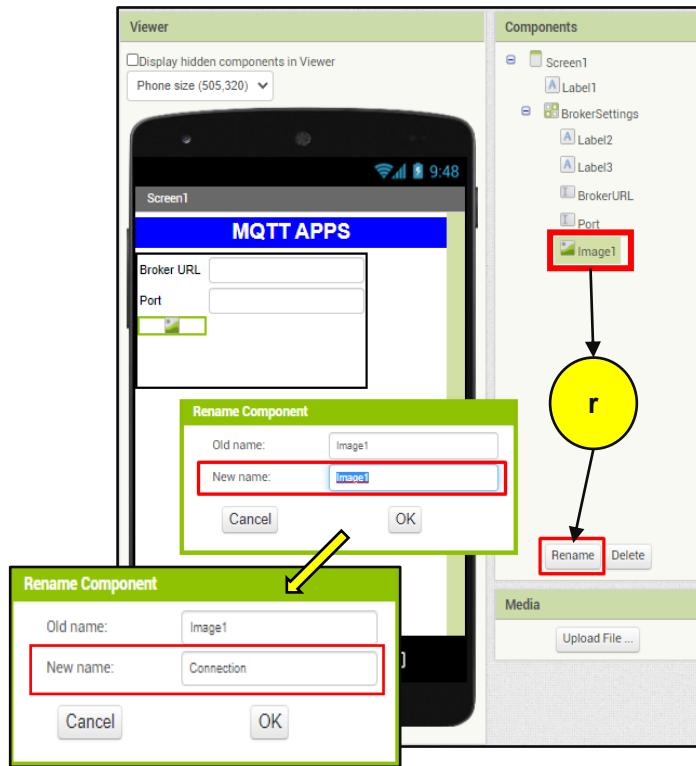


- q. After that, on the third row of **BrokerSettings** layout, we will be adding an Image.

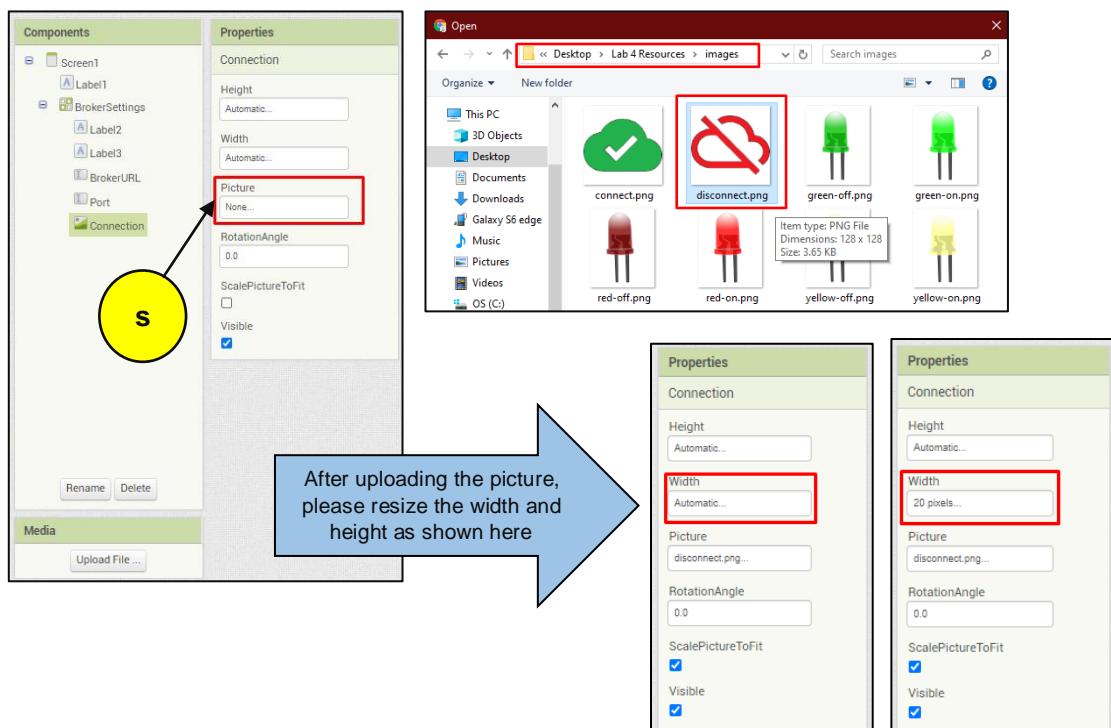


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- r. Then, rename Image1 at the Components to Connection

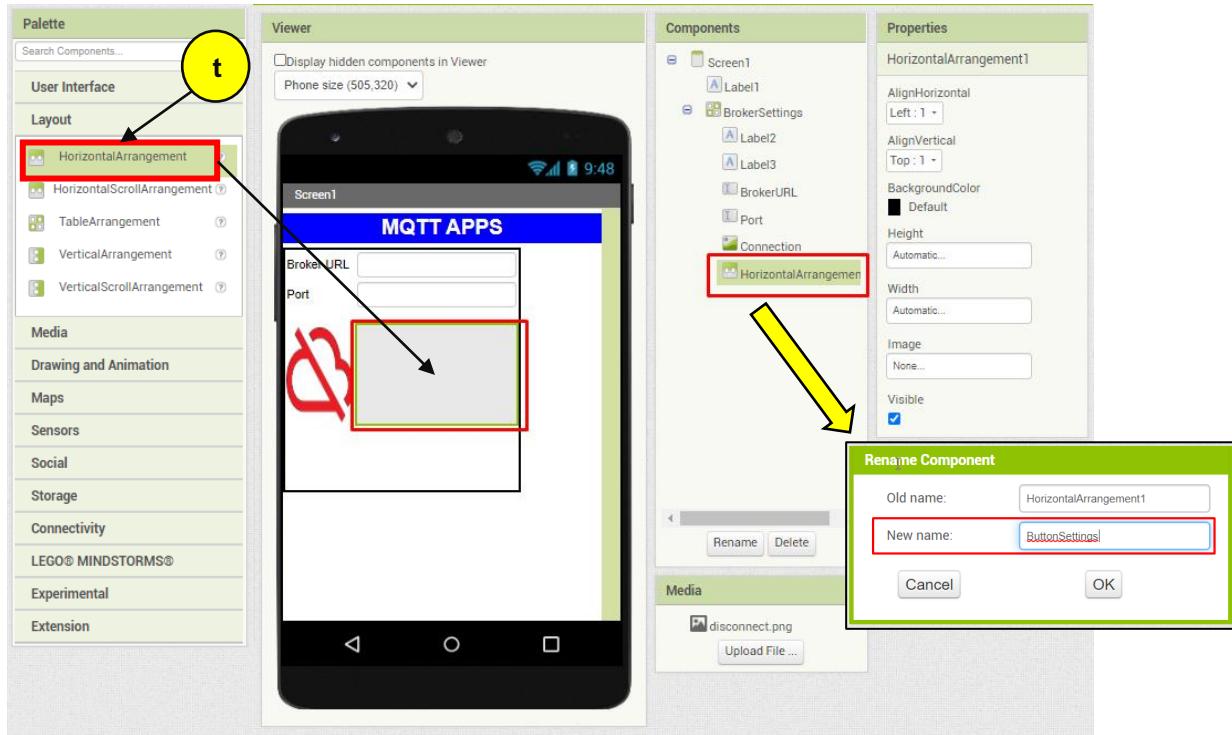


- s. Next, add a Picture to the image. You will be given a folder named "Lab 4 Resources". In the file, there are several images being provided to you. For this image, choose the disconnect.png file. Also, change the Width and Height of the picture as show in figure below.

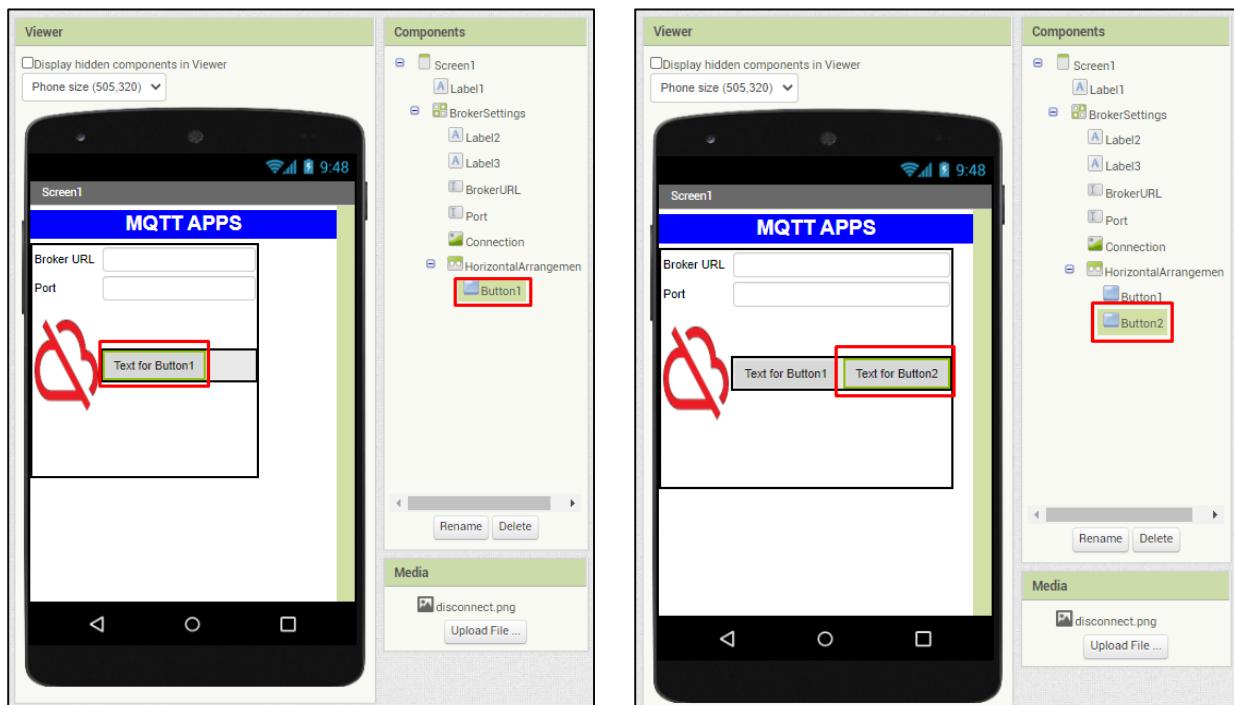


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- t. Next, we will add a HorizontalArrangement layout to the column next to the Connection Image. Also, we will be renaming it to **ButtonSettings** (see figure below)

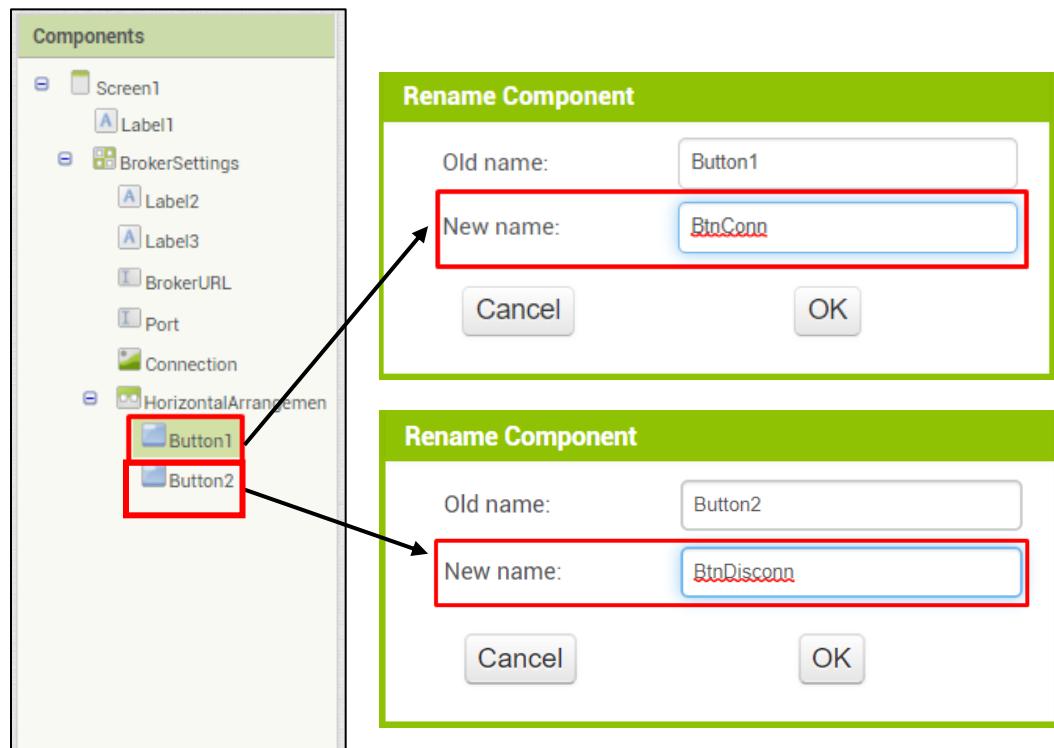


- u. Then, in the **ButtonSettings**, we will be adding two (2) buttons

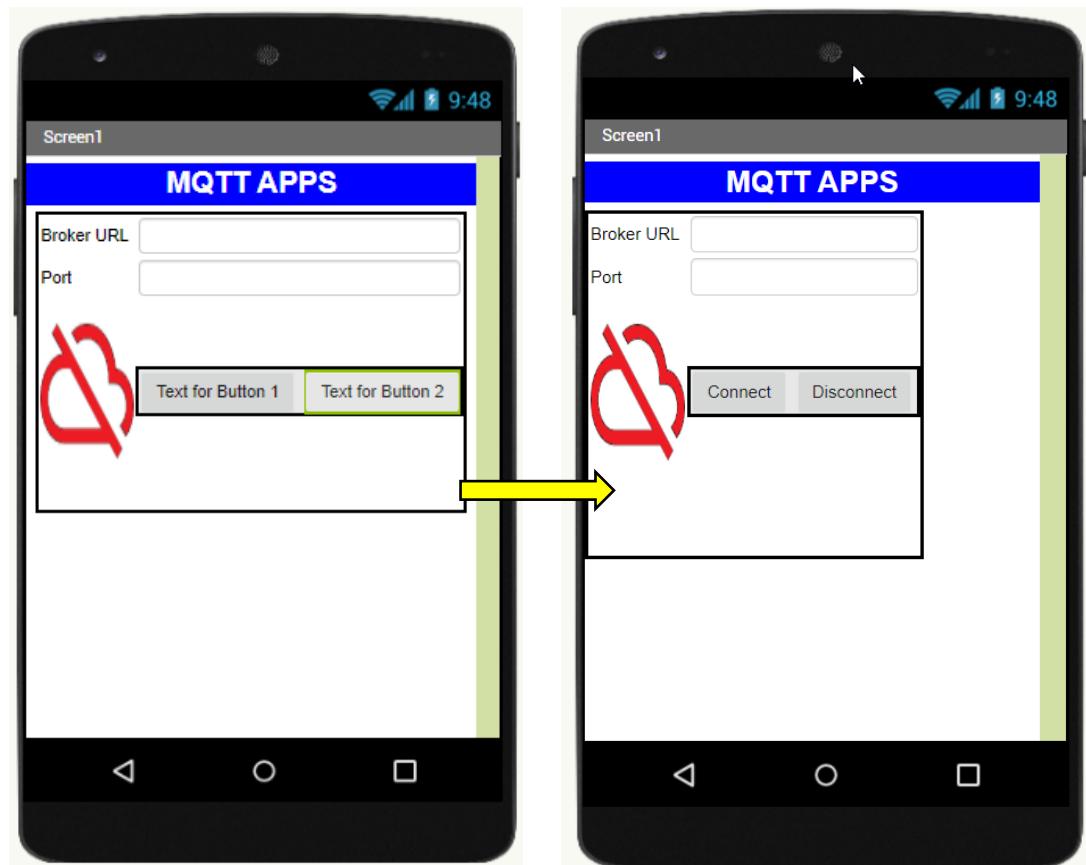


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- v. Rename each respective button as shown in figure below.

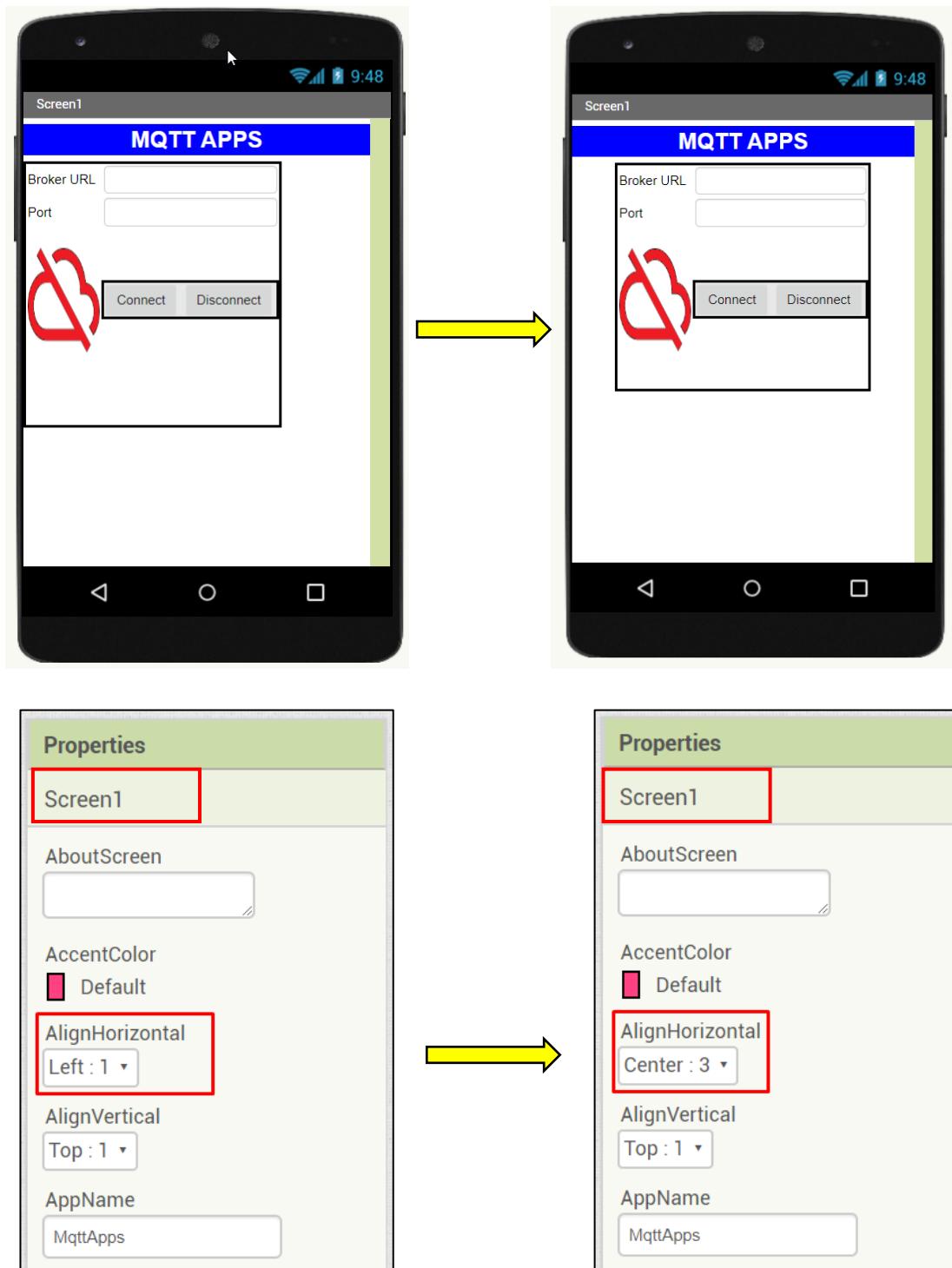


- w. Also, we will be changing the Text on the both button as **Connect** and **Disconnect** respectively (see figure below)



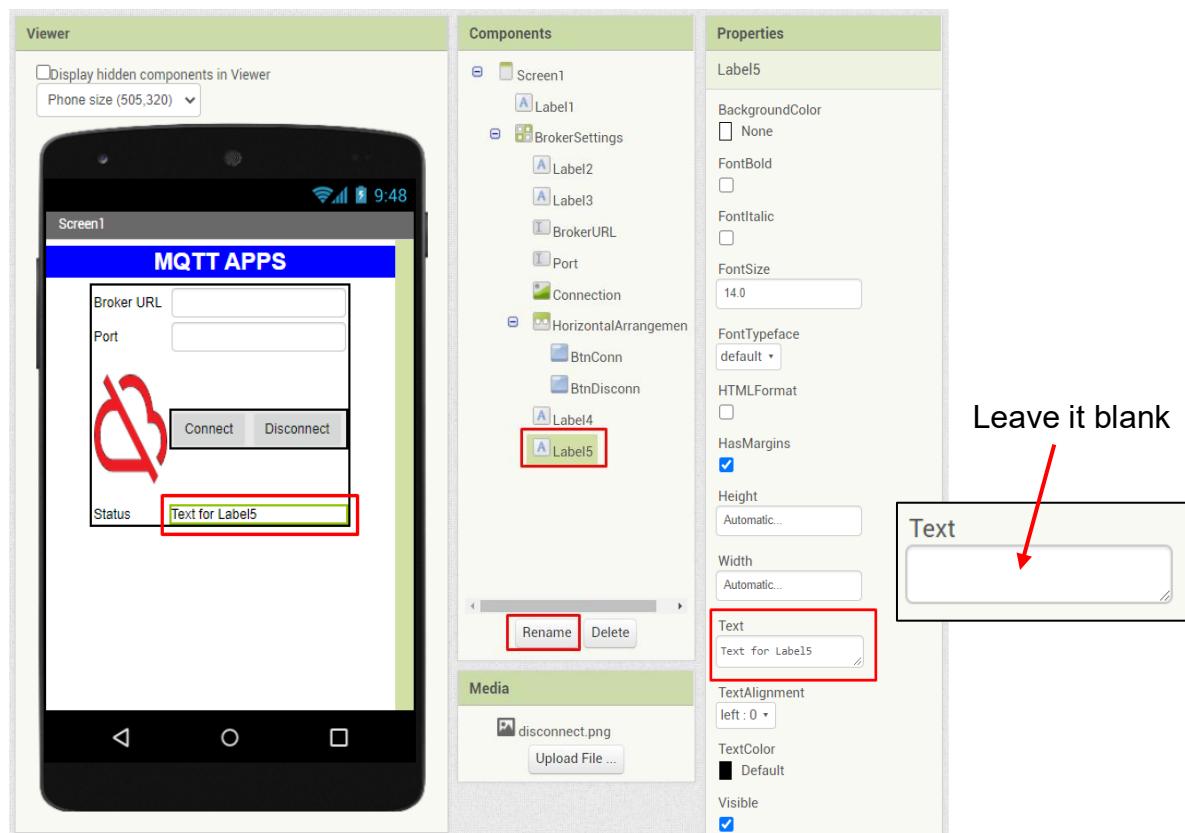
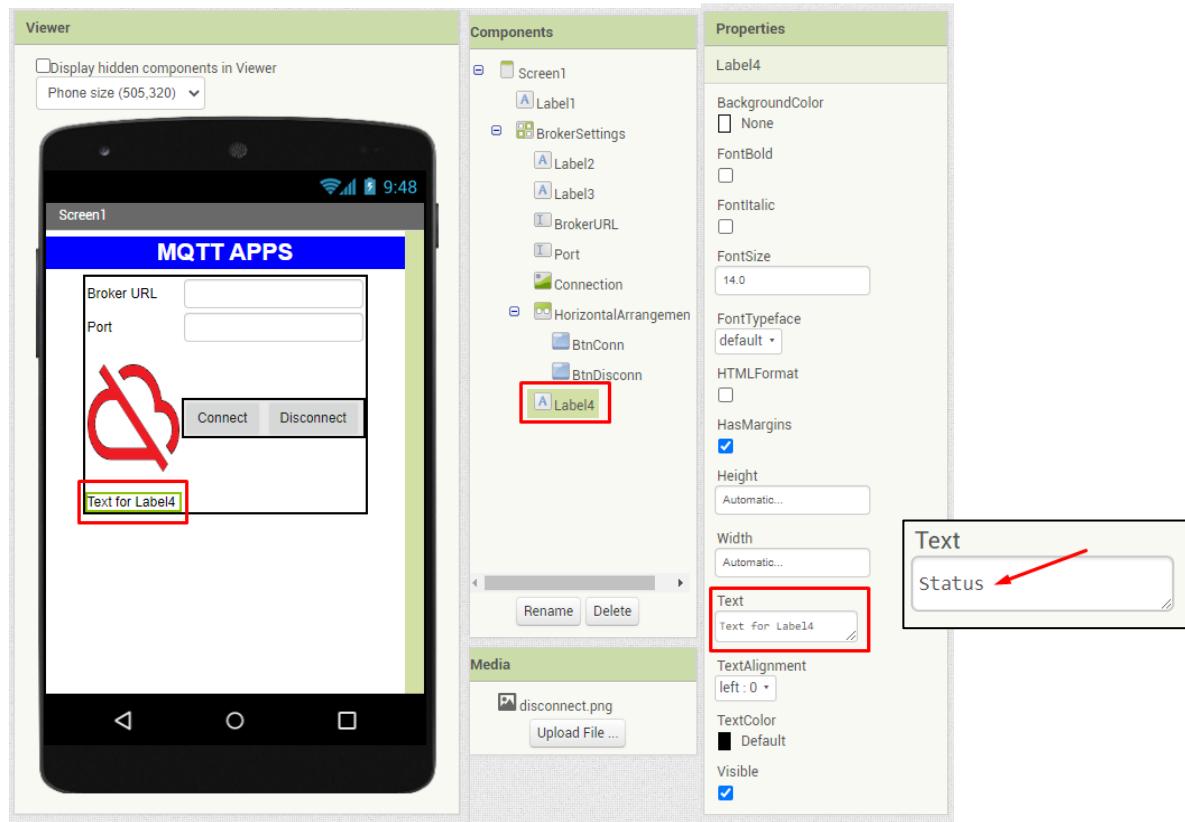
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- x. Next, we will align the **BrokerSettings** layout to the centre. To do this, simply change the alignment at the Component of Screen1 from **AlignHorizontal: Left** to **AlignHorizontal: Centre**



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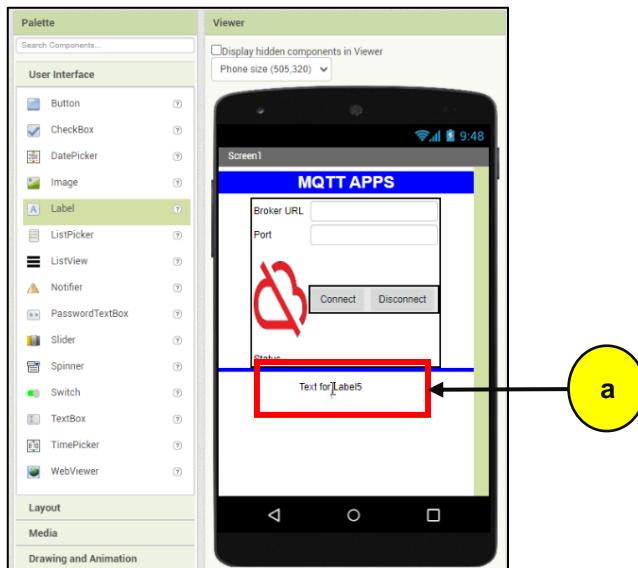
- y. Lastly, we will add another **two (2) label** at the last row and column of the **BrokerSettings**. See figure below for configuration at the Properties for both label



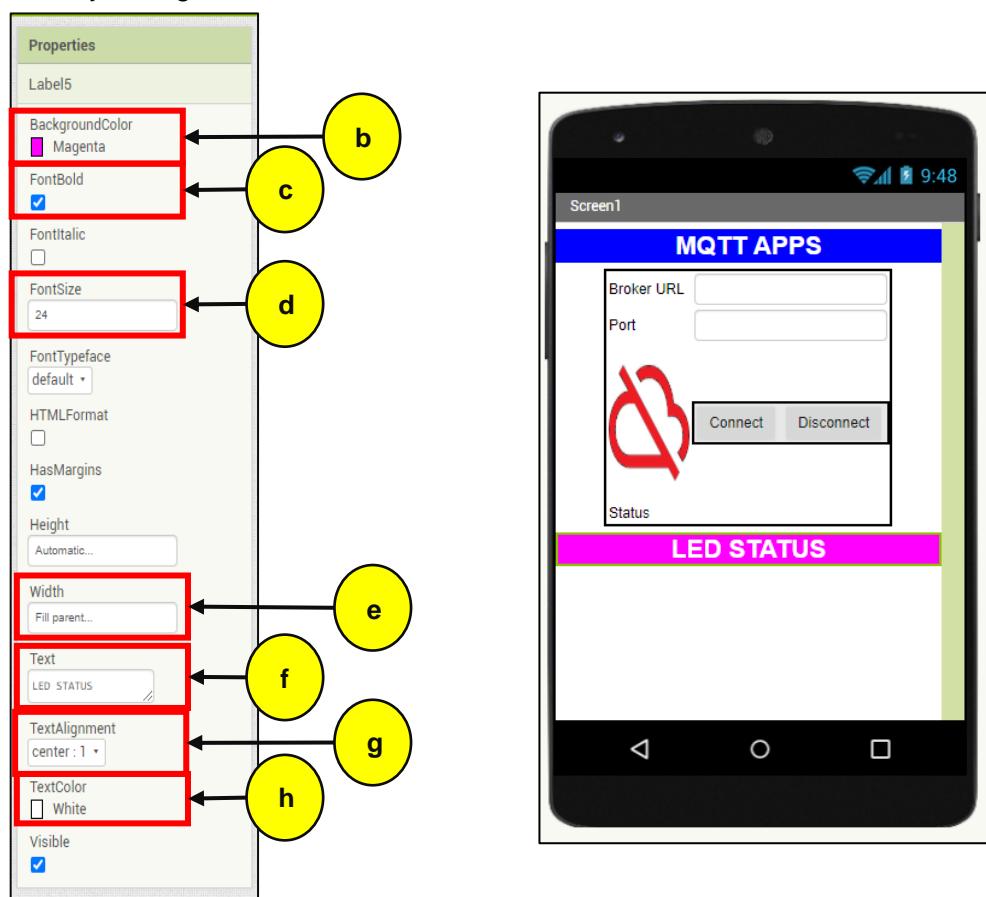
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3. Designing LED Status

- Add a Label underneath the BrokerSettings layout.

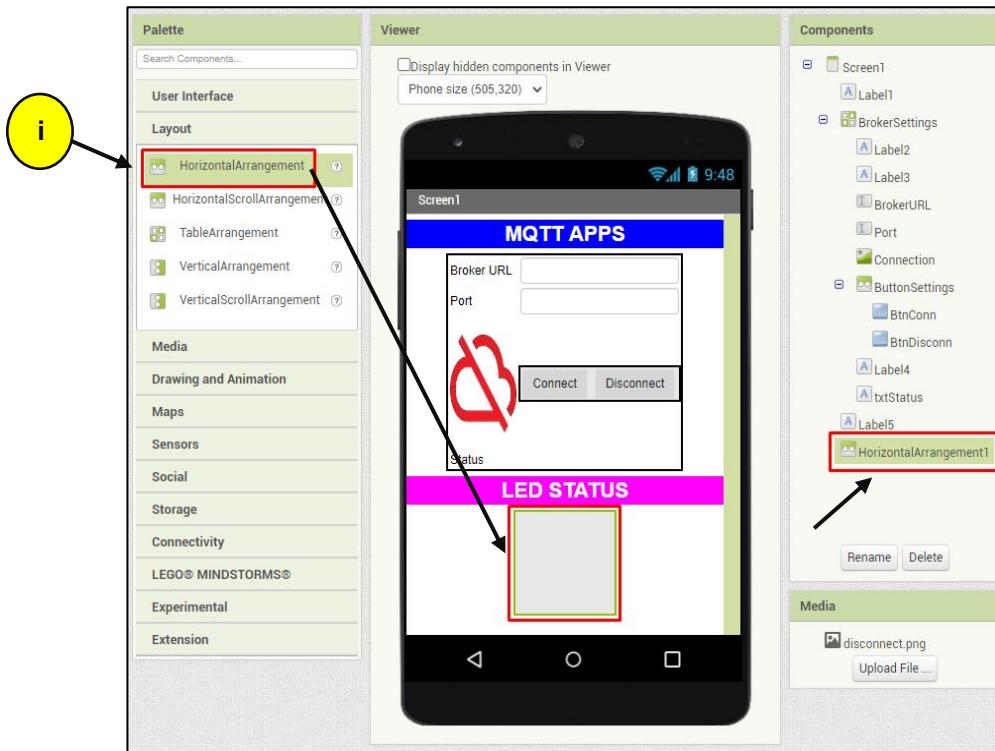


- Change the **BackgroundColor** to *Magenta*.
- Checked** on the checkbox for **FontBold**.
- Then, change the **FontSize** to **24**.
- Resize the label **Width** to *Fill parent*.
- Change the **Text** to “LED STATUS”.
- Then, we are going to change the **TextAlignment** to **center : 1**.
- Lastly change the **TextColor** to *White*.

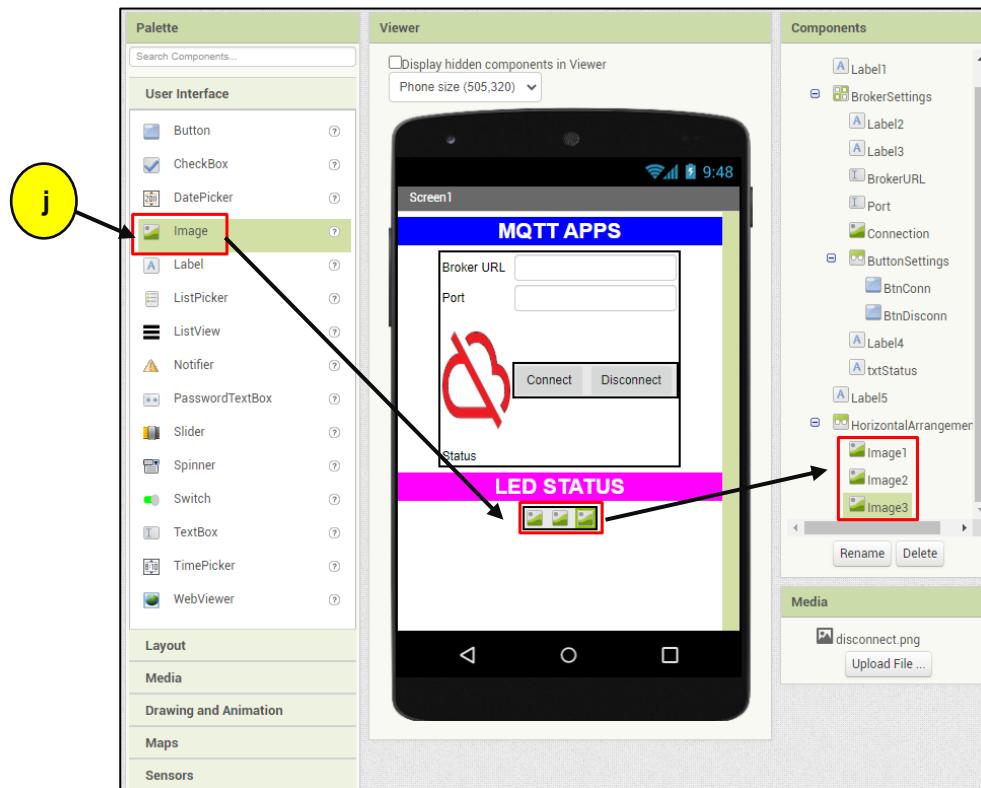


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- i. Then, we will add a HorizontalArrangement Layout underneath the Label5



- j. Next, add three (3) Image from the User Interface and add it into the **HorizontalArrangement1** as shown in figure below.



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- k. We will be adding source of Pictures for each of the images. We will be uploading 3 pictures from the Lab 4 Resources which are red-off.png, green-off.png and yellow-off.png.

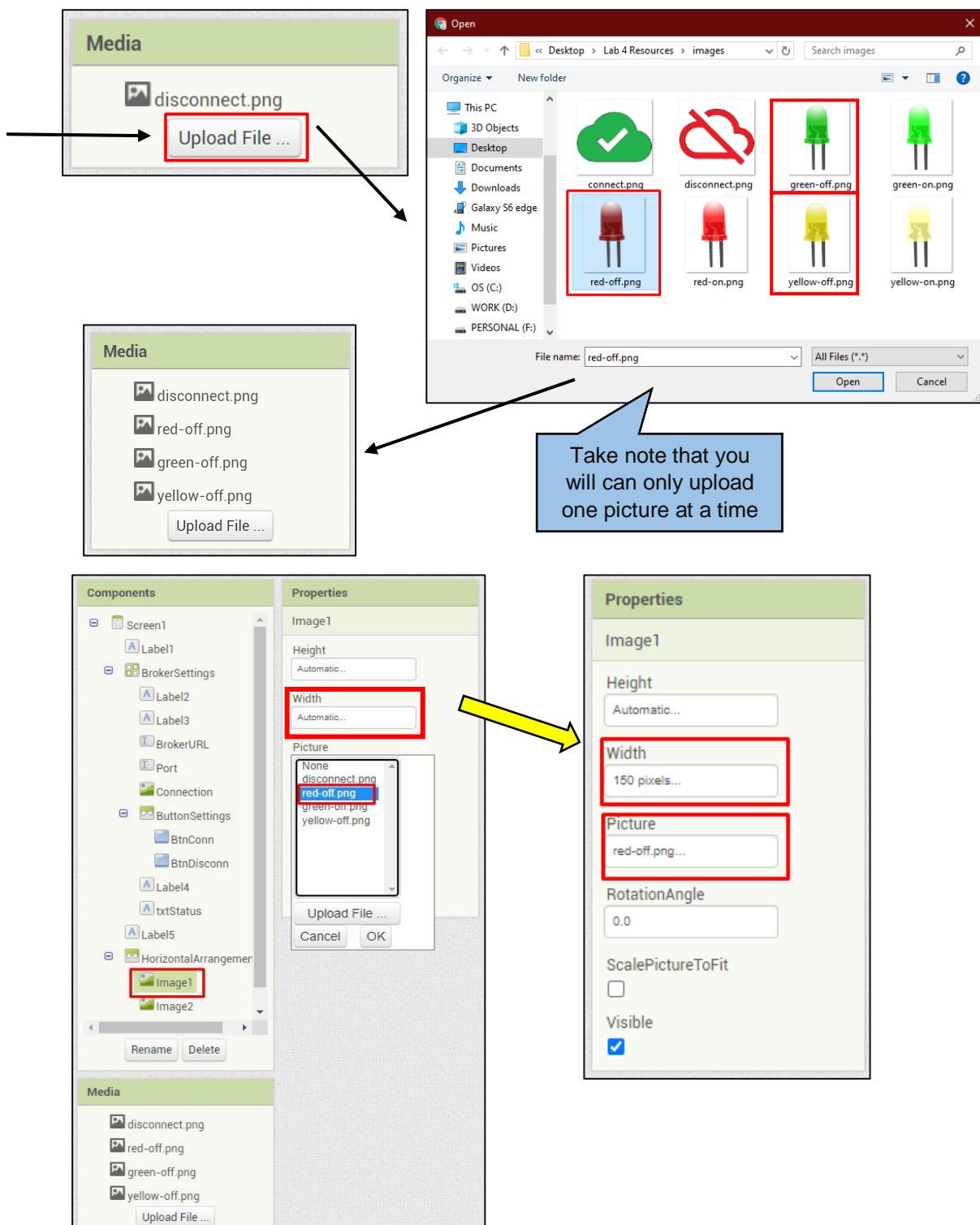
Assign the pictures sources as follows:

Image1: **red-off.png**

Image2: **green-off.png**

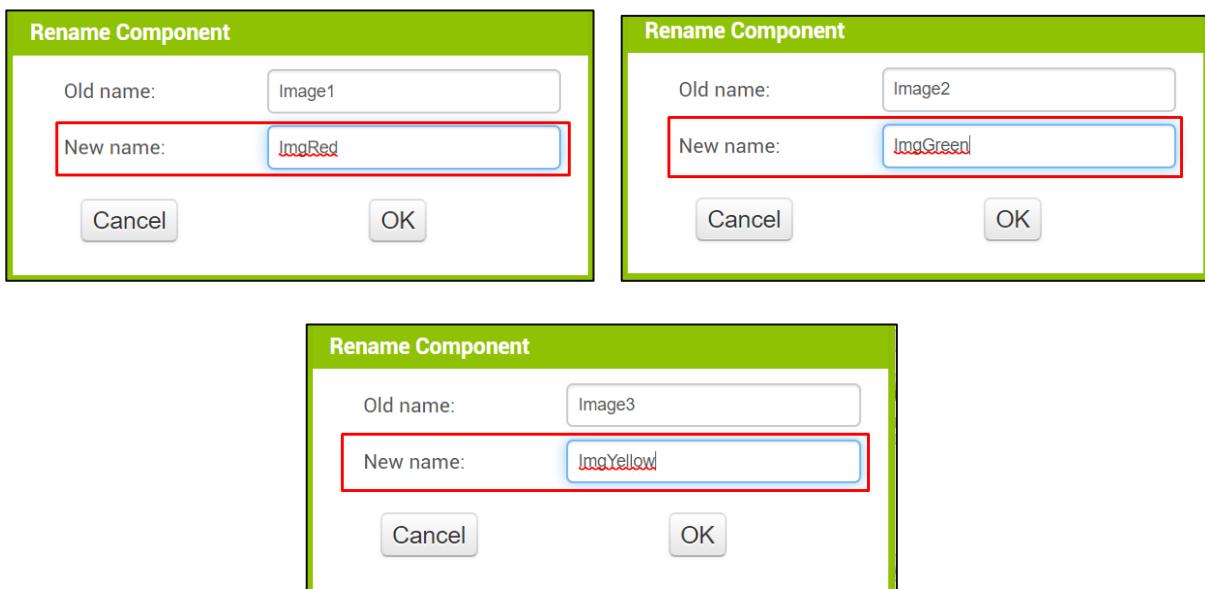
Image3: **yellow-off.png**

Also, we will need to resize the width of the pictures (see figure below)

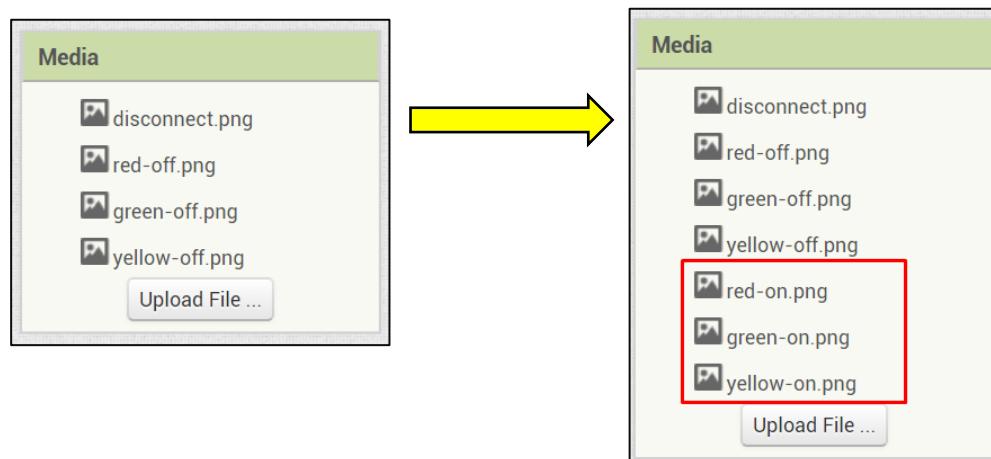


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- I. Then, we will be renaming Image1, Image2, and Image3 as shown in the figure below:



- m. Lastly we will be uploading the remaining three (3) images which are red-on.png, green-on.png and yellow-on.png.



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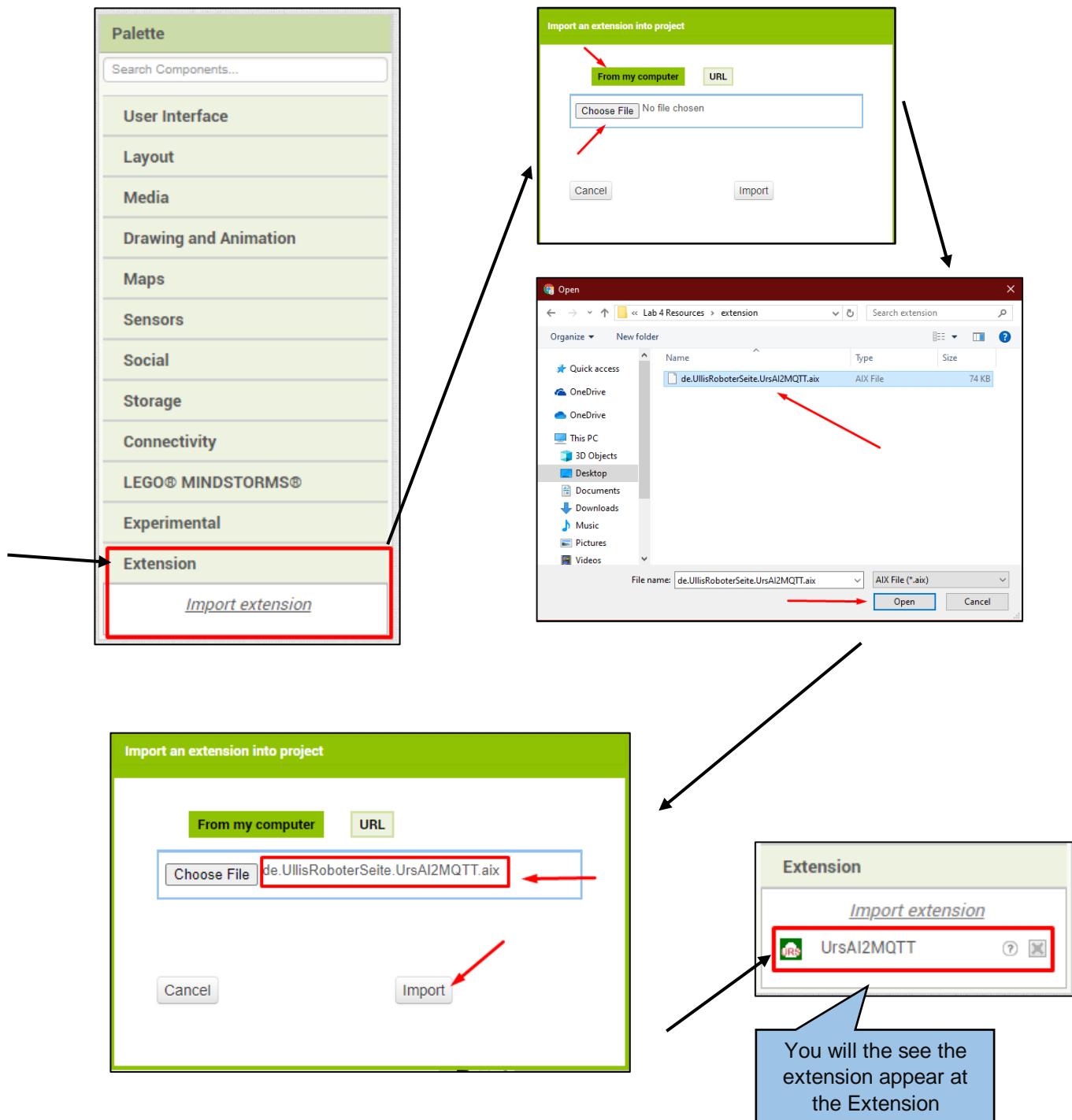
4. Coding the Connection Settings

We will be using an extension from <https://ullisroboterseite.de/android-AI2-MQTT-en.html>. The extension will be provided in the Lab 4 Resources. We will need to upload the extension to the MIT App Inventor2 server.

Based on the guide from <https://ullisroboterseite.de/android-AI2-MQTT-en.html>

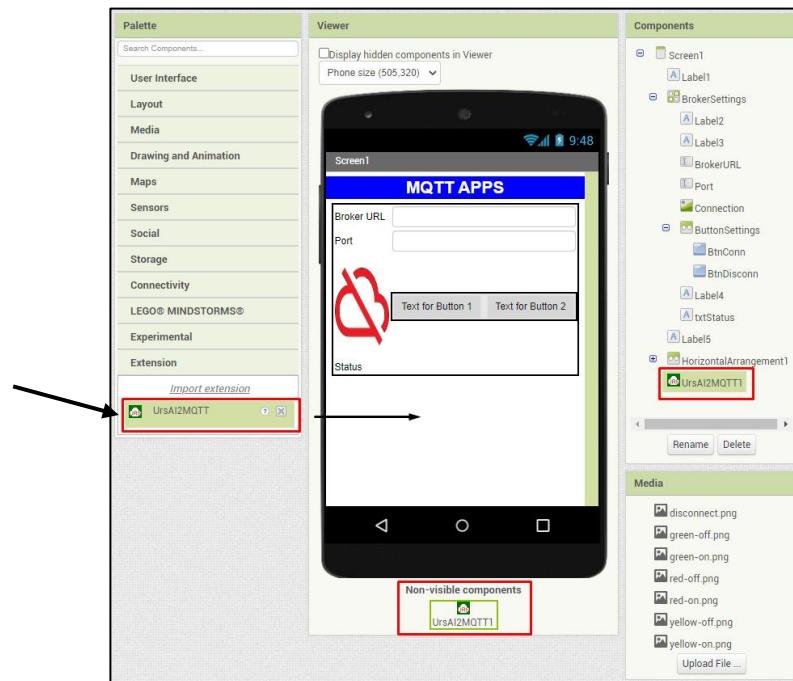
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- a. First, import the extension into the Palette. Go to Extension and click on Import extension. Choose the extension in the Lab 4 Resources.



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- b. Then, drag and drop the extension to Screen1. As you can see the extension is a Non-visible components. Meaning, the extension does not appear on the screen.

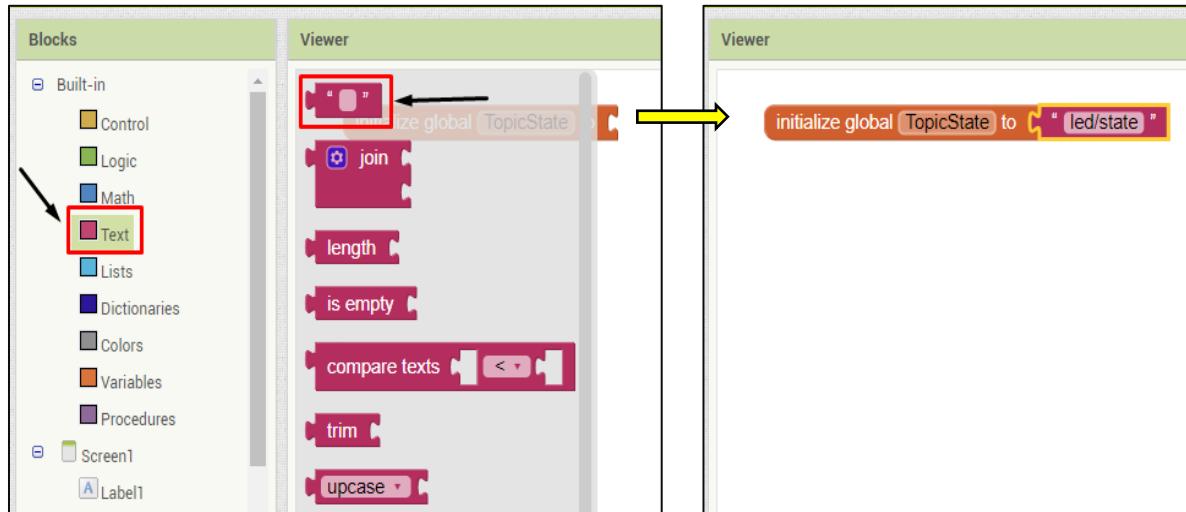


- c. Now, switch over to the MIT App Inventor Blocks
d. Then, at the Built-in blocks, select the **Variable** blocks. Choose the **initialize global name to** block and drag and drop it onto the Viewer. Change the name to **TopicState**.

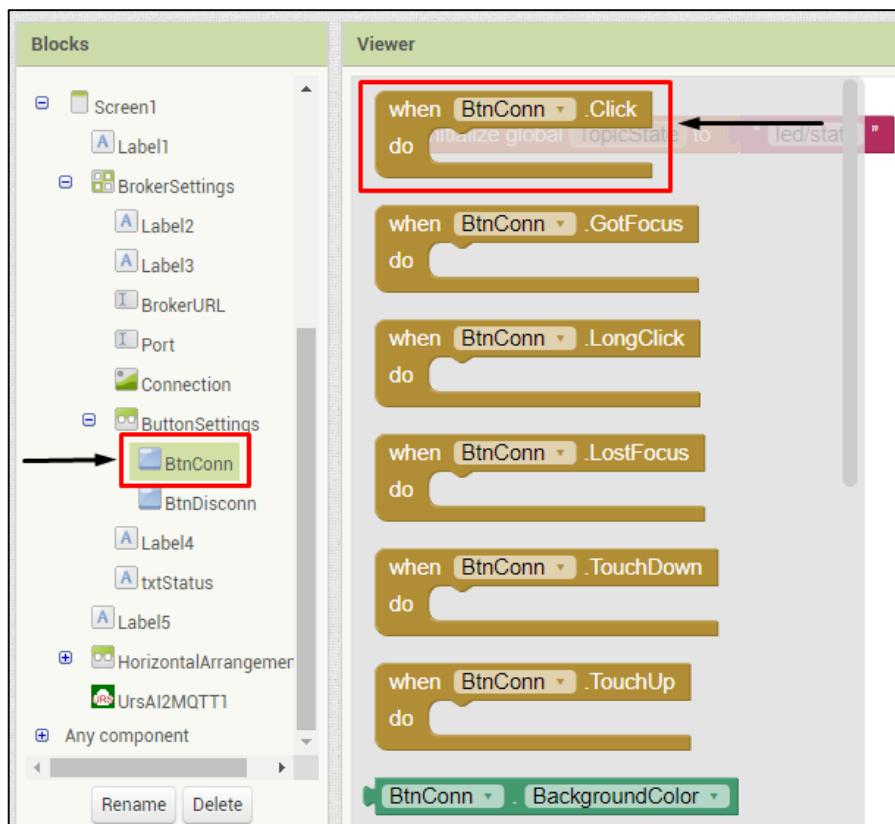


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- e. After that, go to **Text** blocks and choose the **String** block. In the String block typed in “**led/state**” and attached it to the **initialize global block** that we add previously.

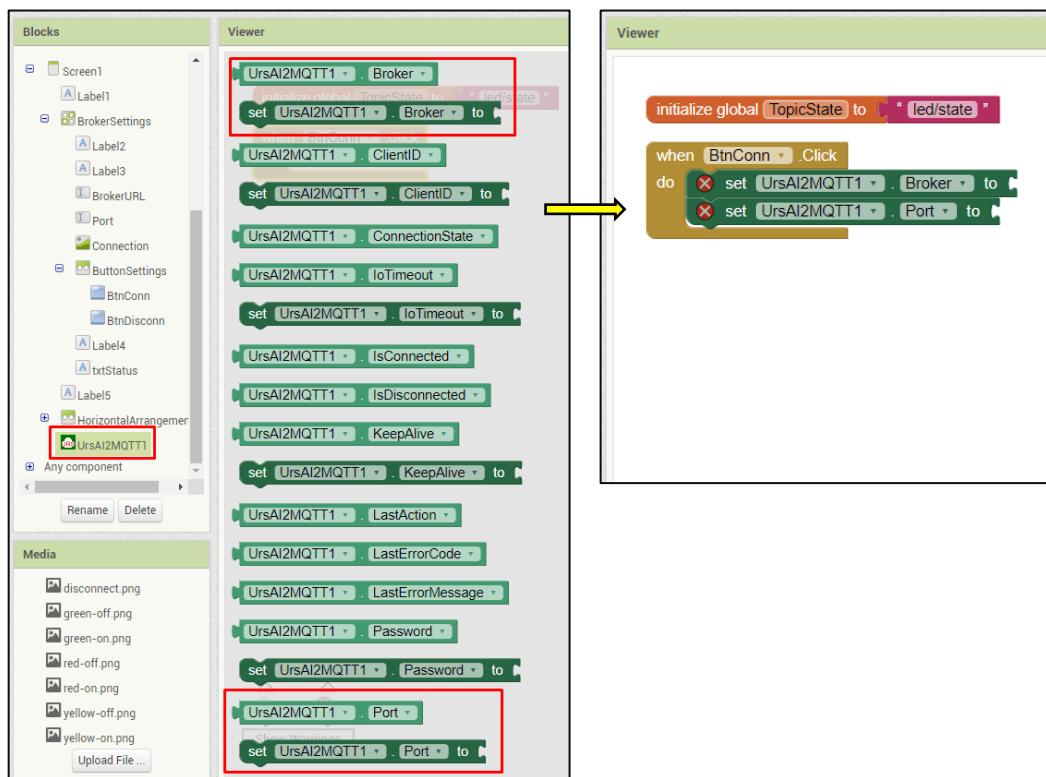


- f. Next, go to the **Components** block and select the **BtnConn** component. Choose the **when BtnConn.Click block** and drag then drop it to the Viewer

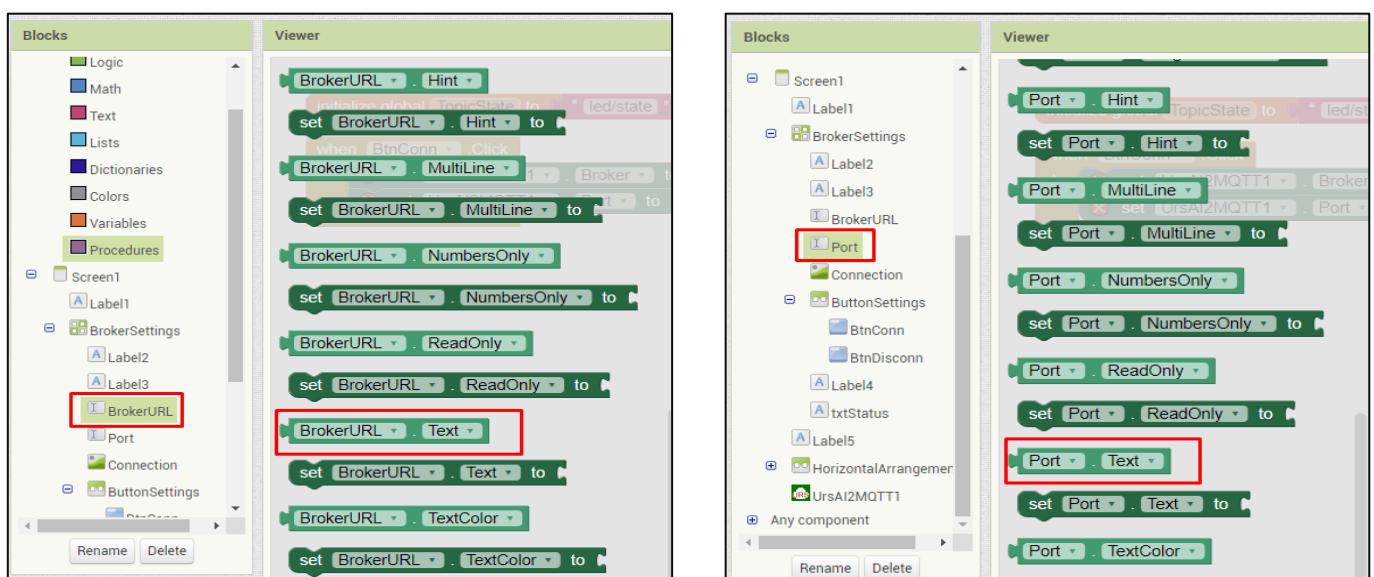


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- g. Go to the ***UrsAI2MQTT1 Extension*** and select the ***set UrsAI2MQTT1.Broker block*** and the ***set UrsAI2MQTT1.Port block***. Then, arrange these blocks to append under the ***when BtnConn.Click block***

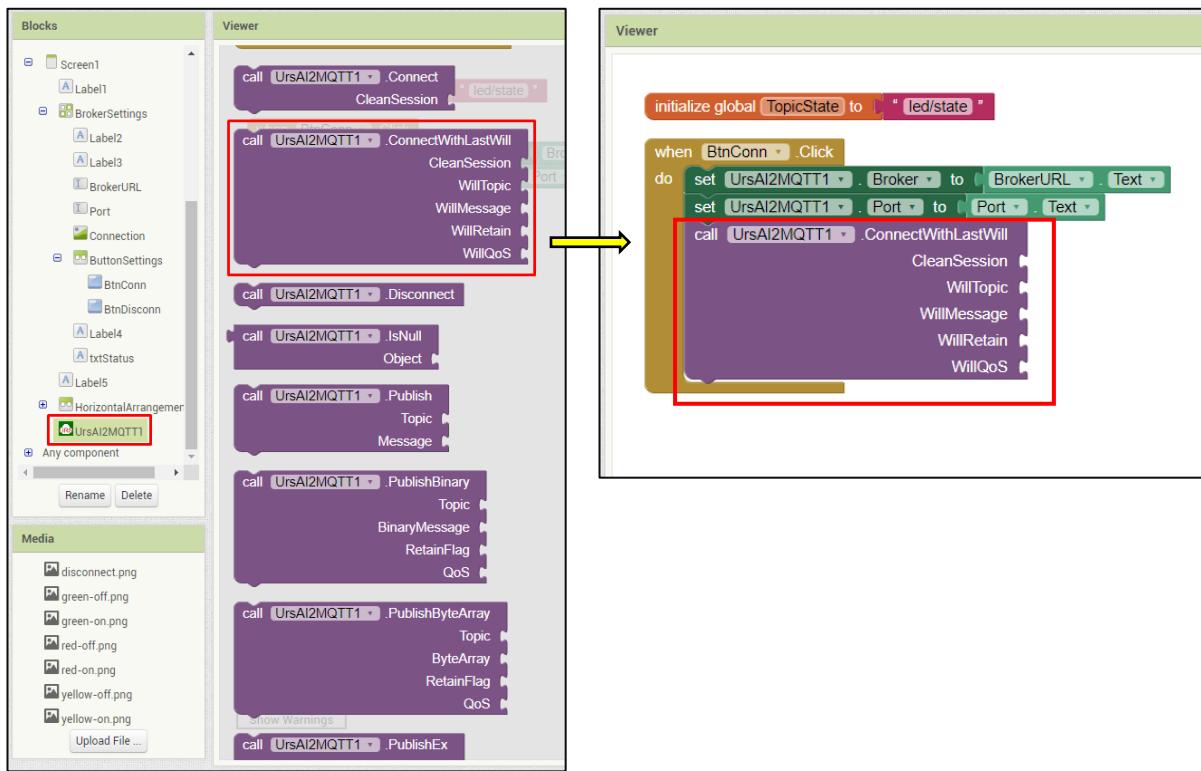


- h. Then, go to the ***Component block*** and select the ***TextBox BrokerURL*** and ***TextBox Port***. Choose the ***block BrokerURL.Text*** and ***Port.Text*** and append it at the blocks we set in the previous step.

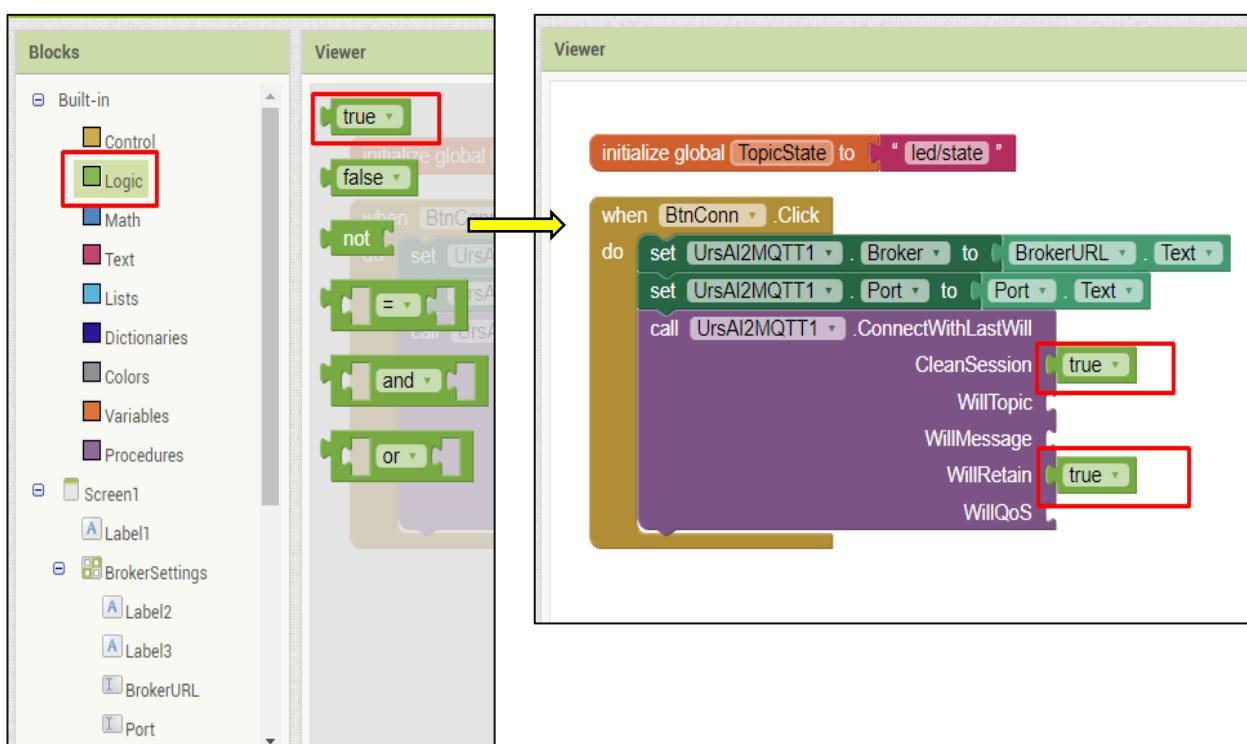


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- i. After that, go to the ***UrsAI2MQTT1*** extension component and select the ***call UrsAI2MQTT1.ConnectWithLastWill*** block. Append it under the Broker and Port settings.

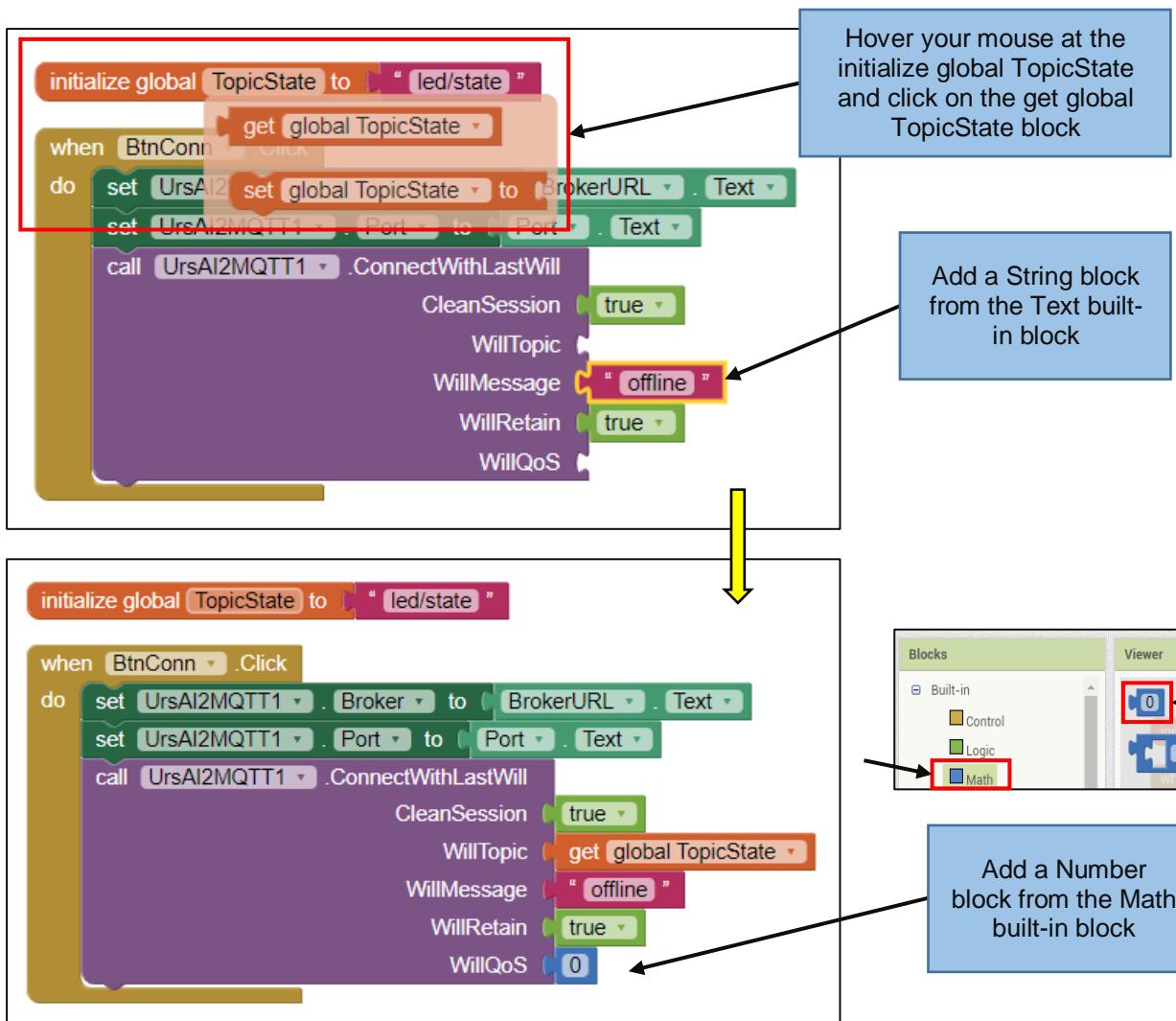


- j. Then, go to ***Logic built-in block*** and select the ***Boolean true block*** and append it at the ***call UrsAI2MQTT1.ConnectWithLastWill*** block as shown in the figure below.



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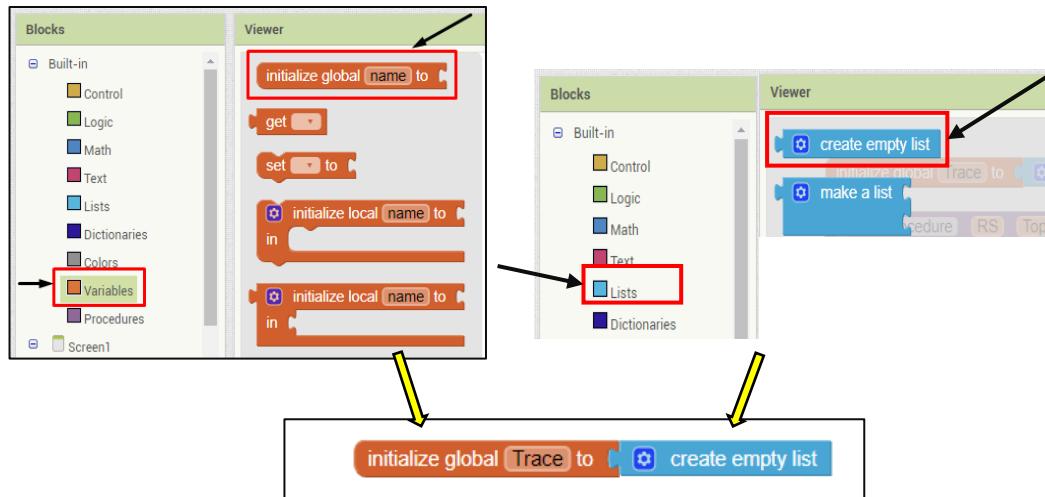
- k. Now, we will configure the **UrsAI2MQTT1.ConnectWithLastWill** as shown in the figure below.



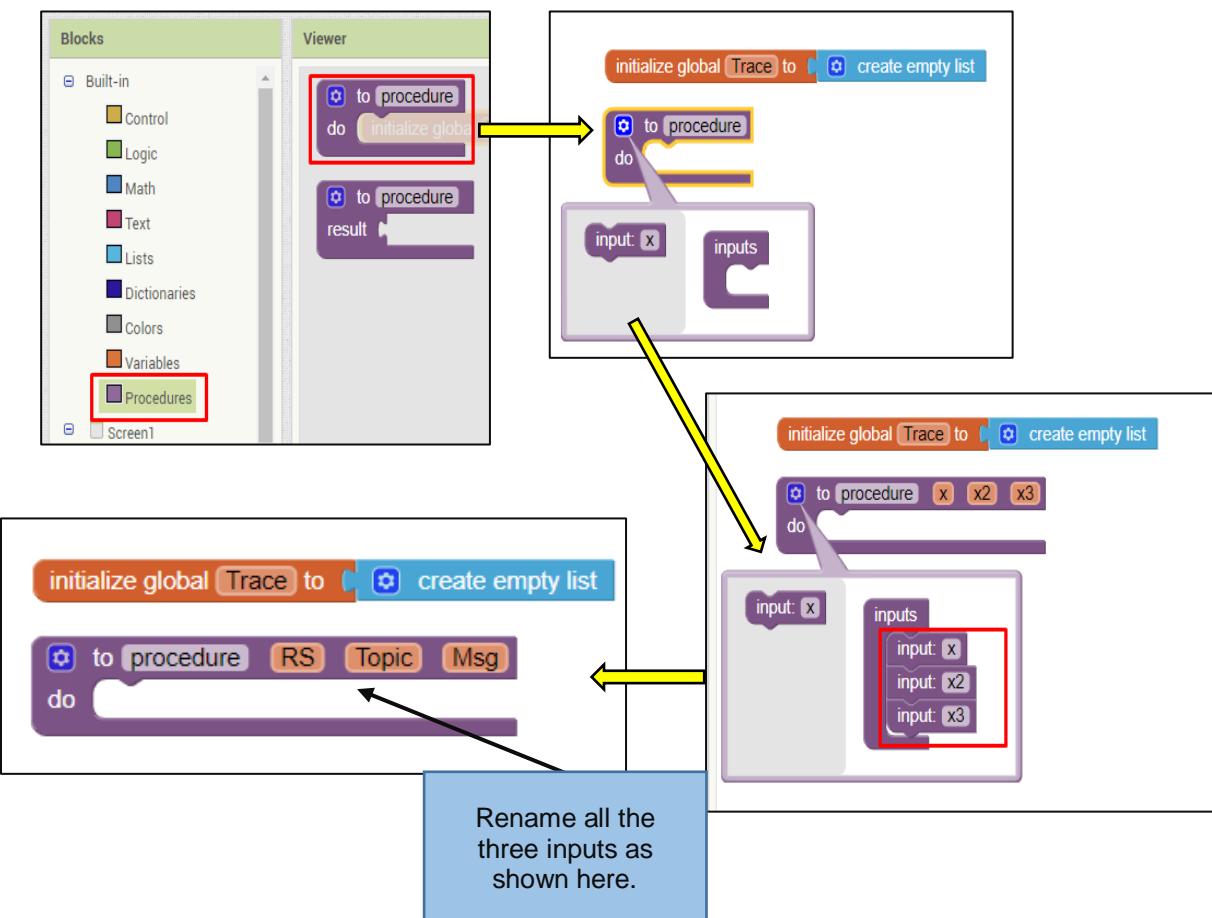
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5. Coding the Topic Settings

- a. Then, go to Variables built-in block and select **initialize global [name] to** block. Next, select create empty list block from the Lists built-in block.

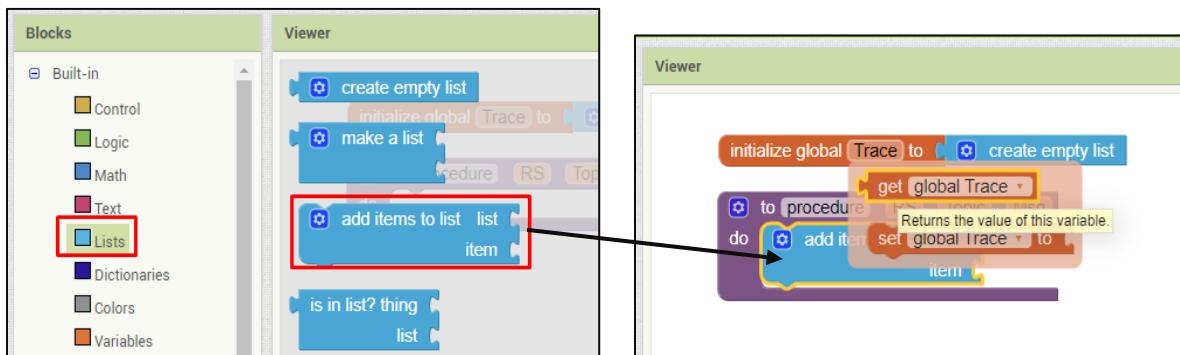


- b. Next, go to the **Procedures built-in blocks** and the **to procedure do block**. Drag and drop to the Viewer. The click at the Setting button at the **to procedure do block**. And add 3 inputs to the block as shown in figure below.

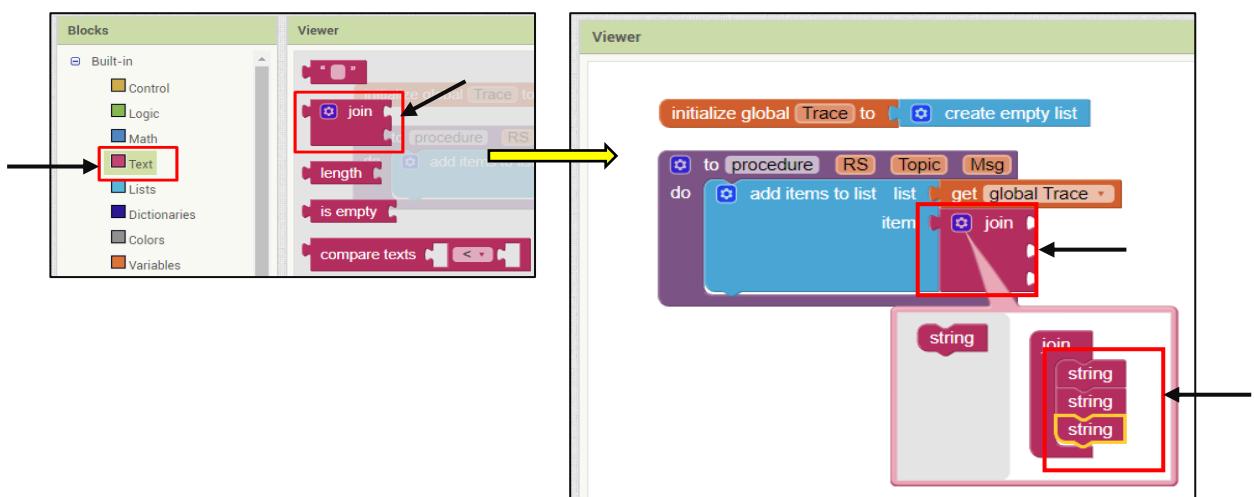


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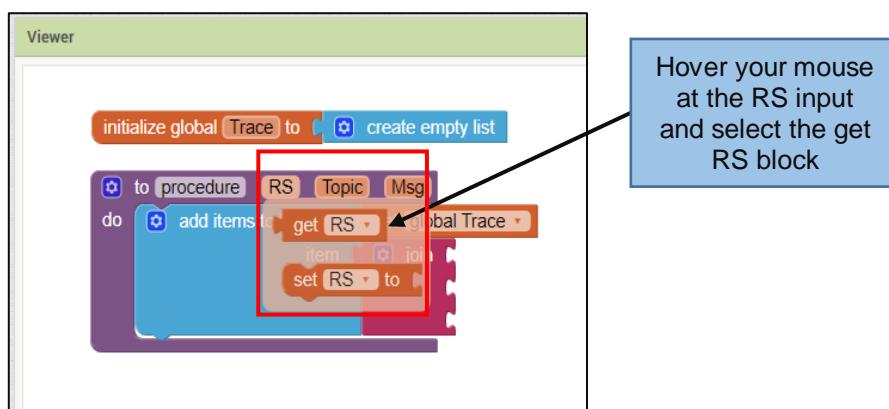
- c. After that, go to the Lists block and select the add items to list block. And append it underneath the procedure block we add in the previous step.



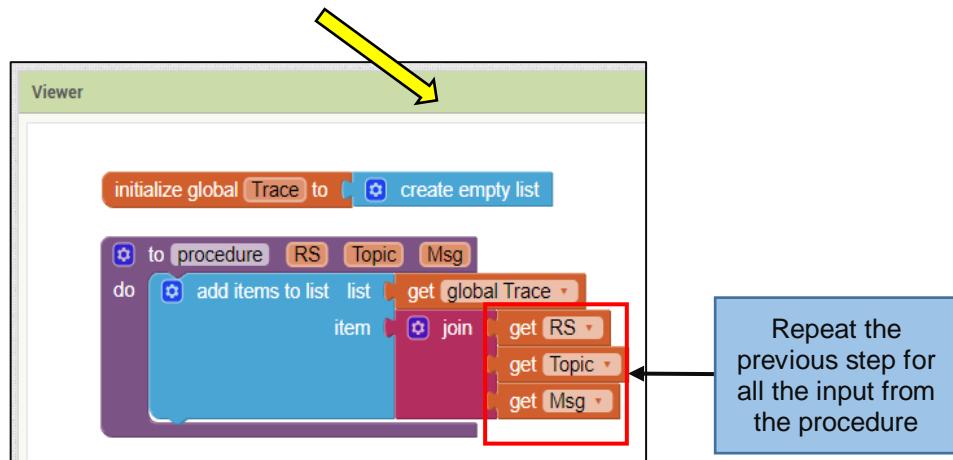
- d. Go to the **Text block** and select the **join block**. Append it to the **add items to list block at the item**. Set the string at the join block to three string as shown in the figure below.



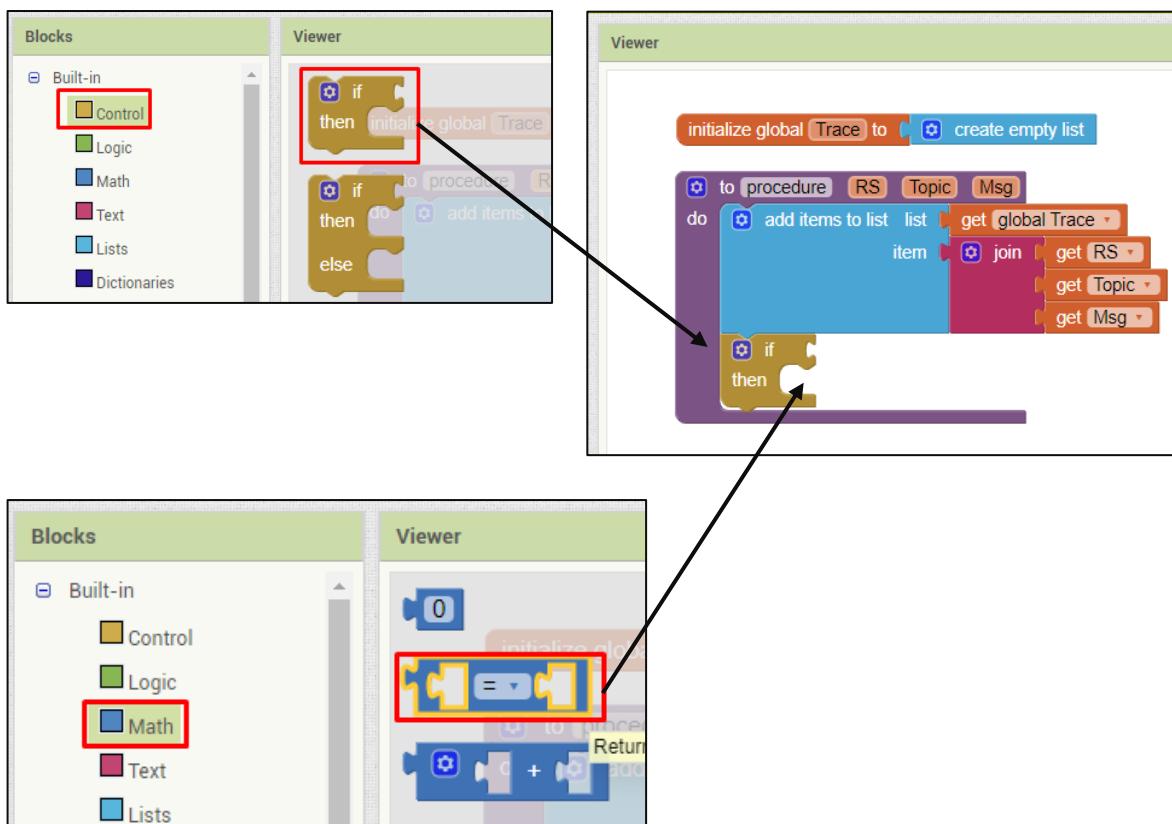
- e. Then, we will need to set the input from the procedure to the join block as show in figure below.



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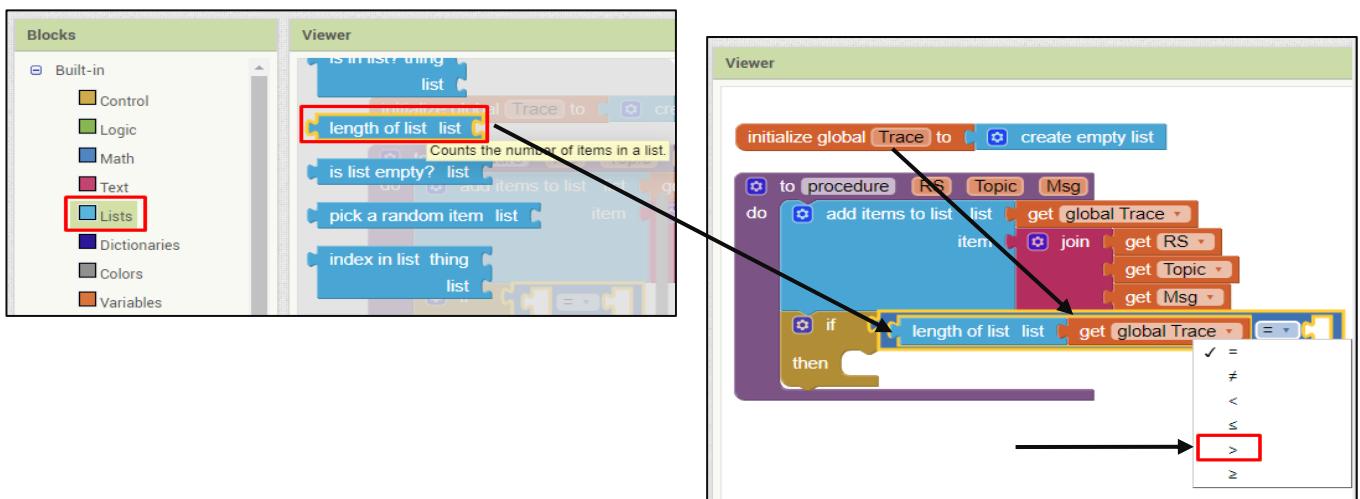


- f. Next, go to the **Control built-in block** and choose the ***if then block***. Drag and drop it underneath the ***add items to list block***. Then, go to the **Math built-in block** and select the ***comparator block*** as shown in the figure below and append it to the ***if then block***.

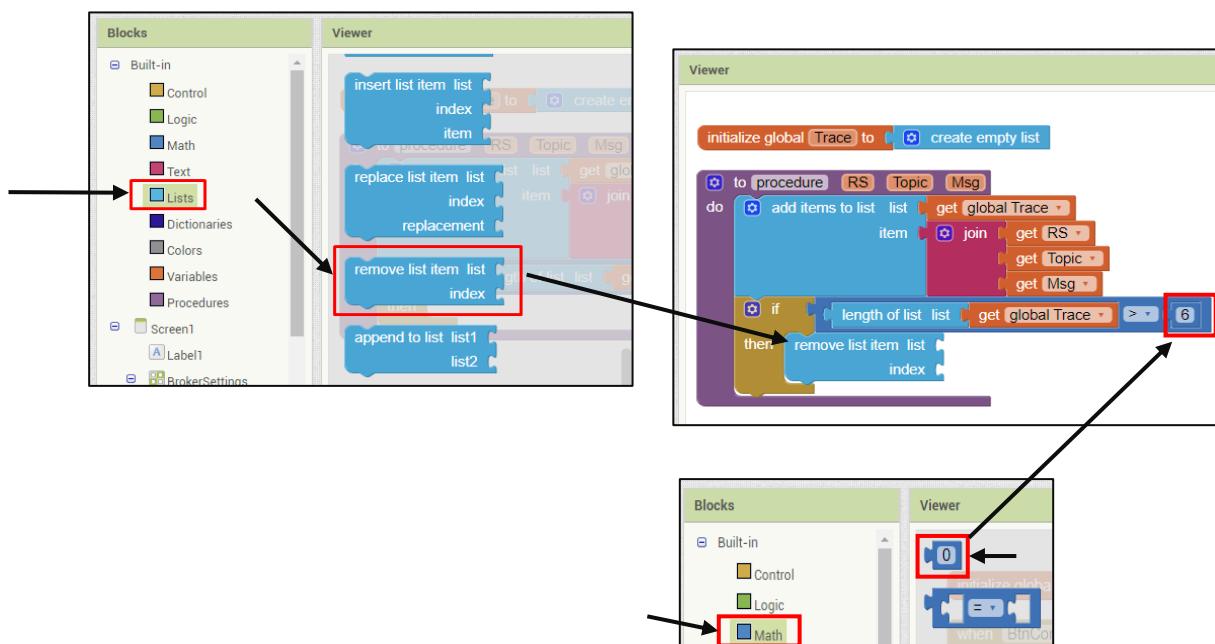


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- g. After that, add the go **to Lists built-in block** and select the **length of list block** to the **comparator block** as shown in figure below. Next to the length of list, append **the get global Trace** (hover to the initialize global Trace and choose get global Trace block. Make sure to choose the **comparator value** as shown the figure below.

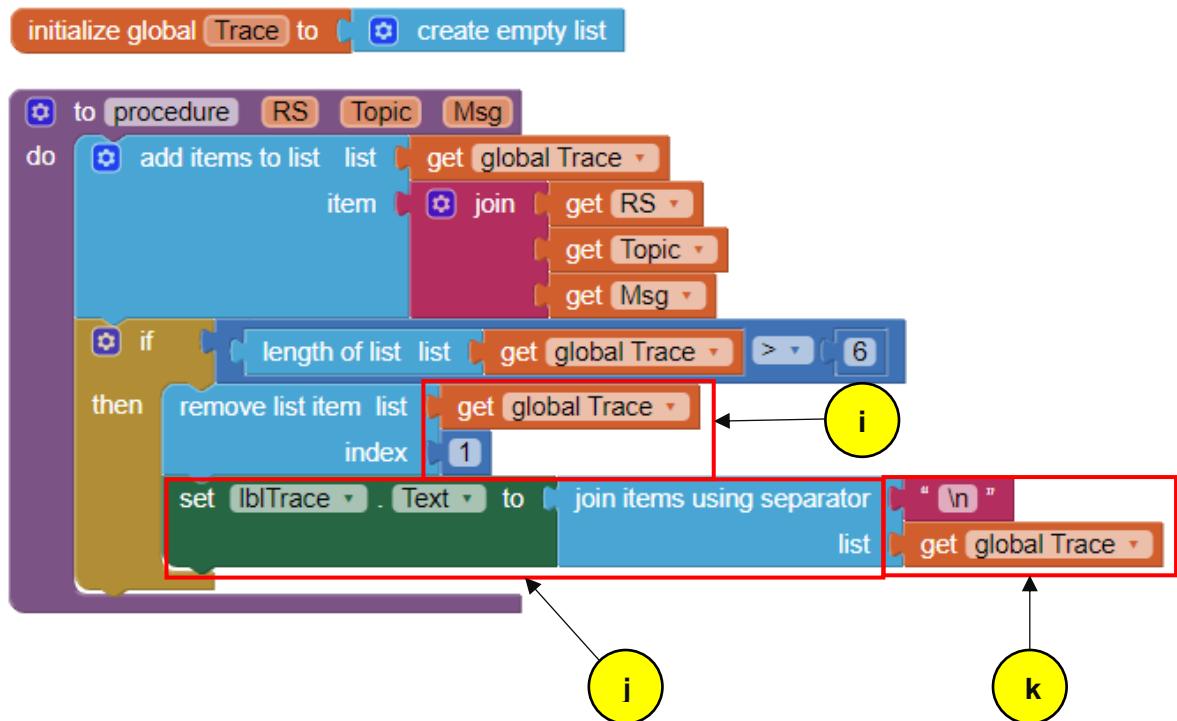


- h. Then, at the Lists built-in block, choose **the remove list item block** and attached under **the comparator block**. Also, add a number to the comparator block as shown in figure below.



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- i. At the **remove list item block**, append the **get global Trace block** at the list and append a **number block** at the index.
- j. Next, add a **set lblTrace.Text block** underneath the **remove list item block**. Then, append the **join items using separator block** to the **set lblTrace.Text block**.
- k. Lastly, append a String block with input “\n” to the the **join items using separator block** as well as the **get global Trace block**.
- l. The end result should look something like the figure below



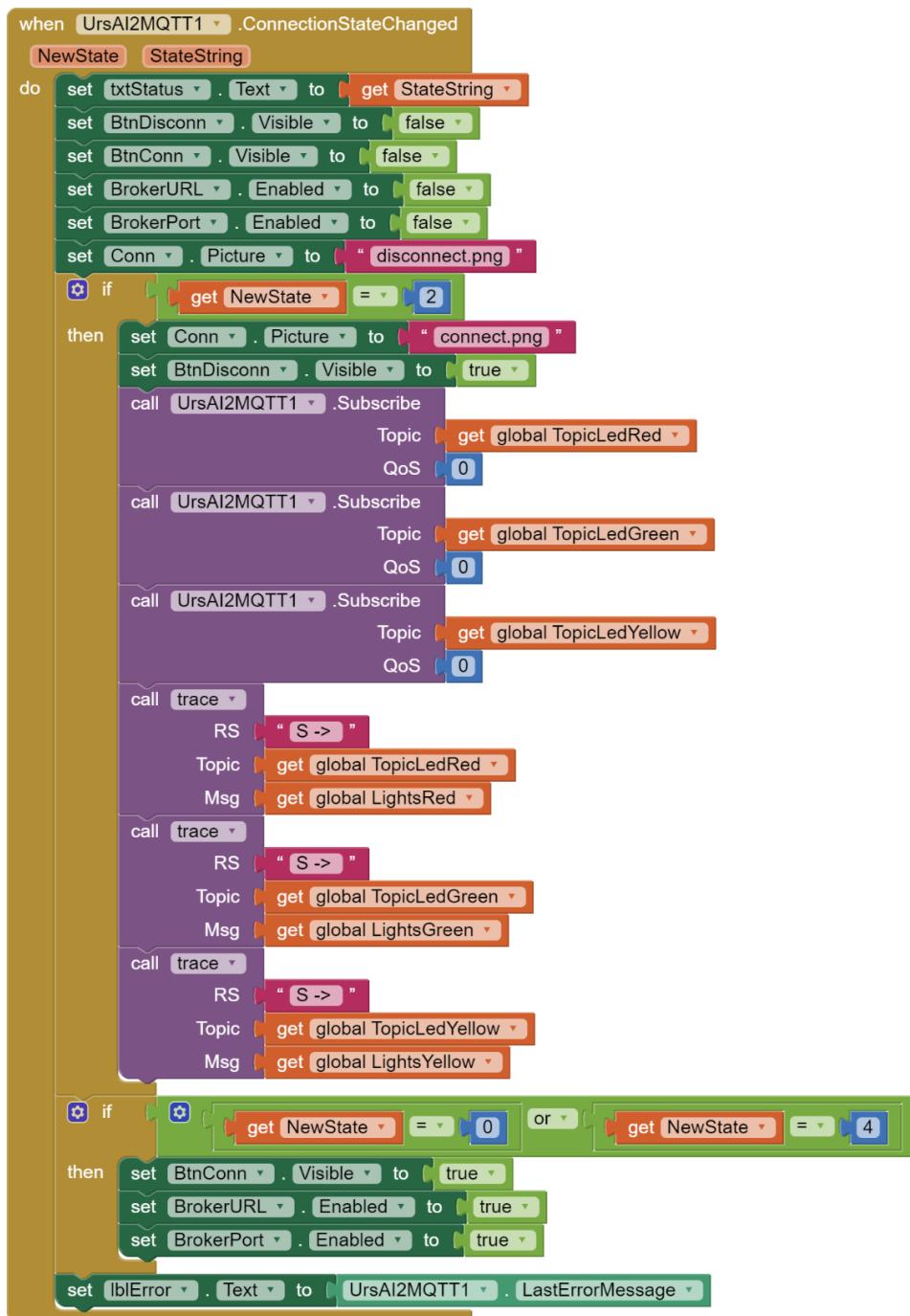
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6. Coding the Connection Change Settings

- Add a initialize global as follows:

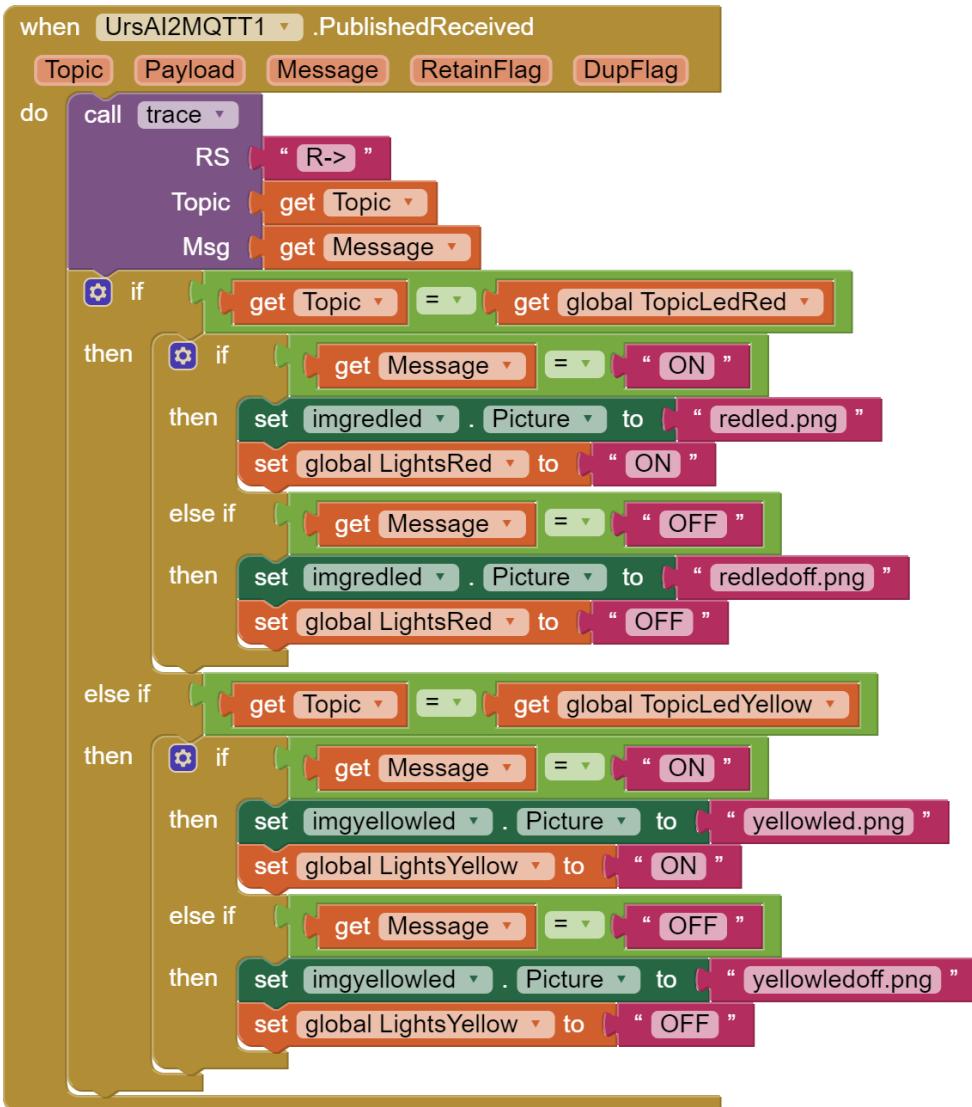
```
initialize global LightsRed to "OFF"  
initialize global TopicLedRed to "xdk/azleen/ledred"  
initialize global LightsGreen to "OFF"  
initialize global TopicLedGreen to "xdk/azleen/ledgreen"  
initialize global LightsYellow to "OFF"  
initialize global TopicLedYellow to "xdk/azleen/ledyellow"
```

- Then, add the following blocks.



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7. Coding the Received Payload



8. Coding the Disconnect Button



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References:

1. <http://appinventor.mit.edu/explore/sites/all/files/teachingappcreation/unit1/MagicTrickHandout.pdf>
2. <https://appinventor.mit.edu/explore/library>
3. <https://appinventor.mit.edu/explore/ai2/tutorials>
4. <https://www.programwithappinventor.org/>
5. <https://www.amazon.com/Learning-MIT-App-Inventor-Hands-On/dp/0133798631/>