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Q&A WITH SPEAKER SPEAKER BIO

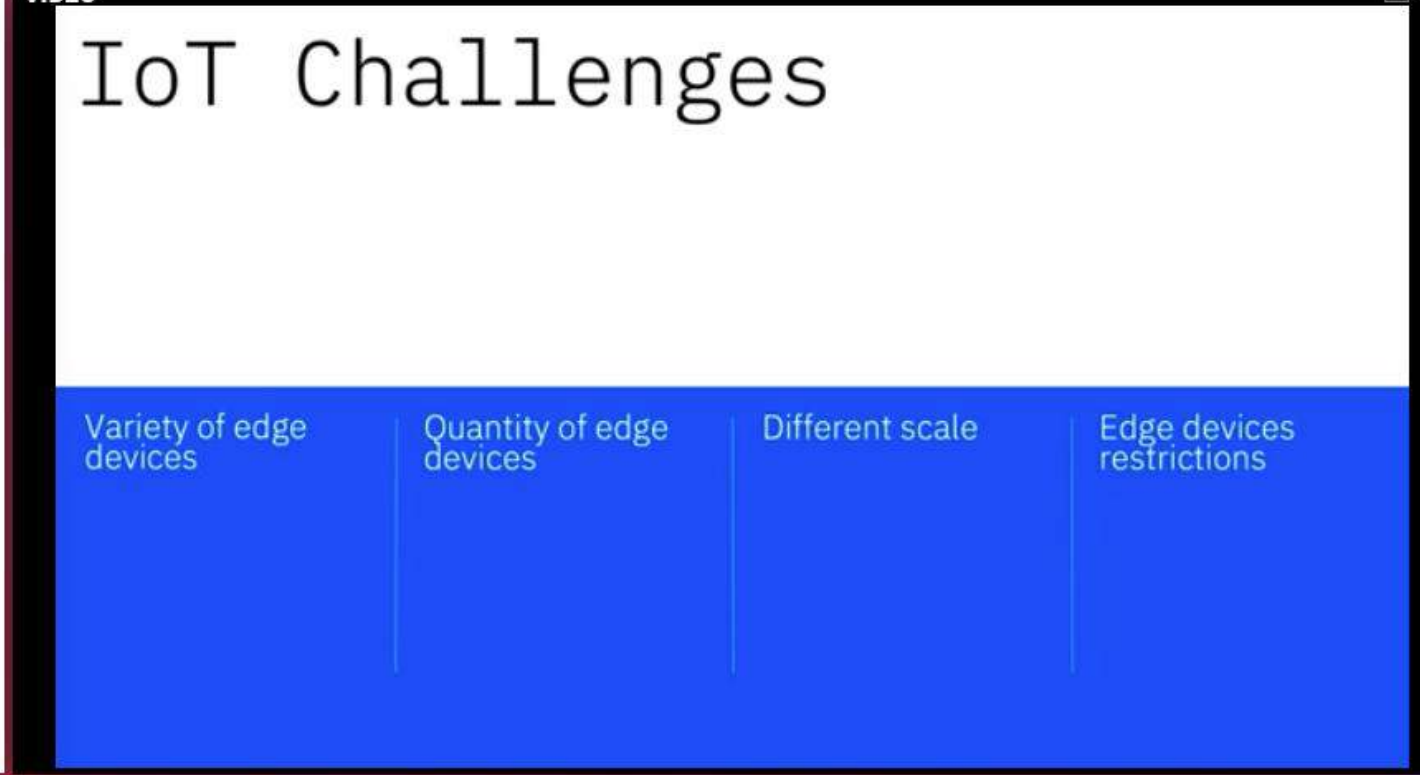
Yi-Hong Wang
Software Developer
IBM

YiHong is a software developer with the Cognitive OpenTech Group at the IBM Silicon Valley Lab. He has been an active contributor in the TensorFlow community for the past 2 years. He is also a committer in the node.JS community.

Va Barbosa
Software Developer
IBM

Va is a software developer with the Developer Advocacy Group at IBM. He has been an active contributor in the TensorFlow community for the past 2 years.

VIDEO



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VIDEO

Node-RED is an open source flow-based programming tool wiring together IoT devices

https://nodered.org

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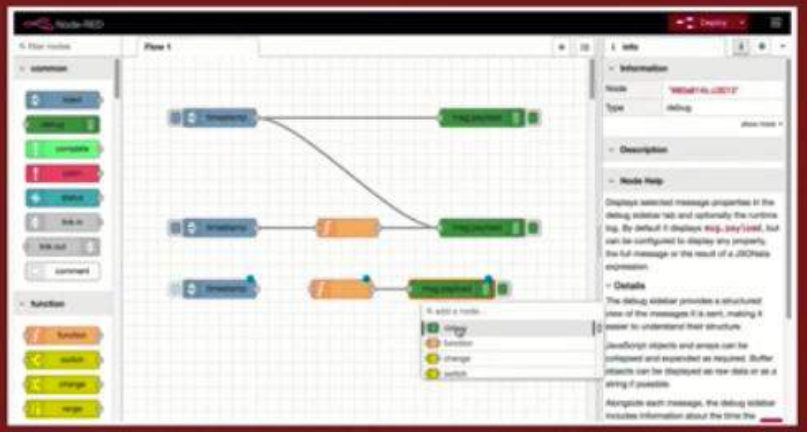

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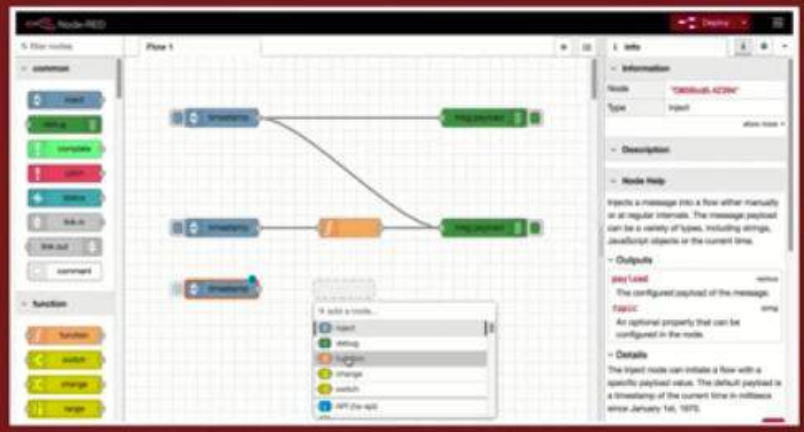

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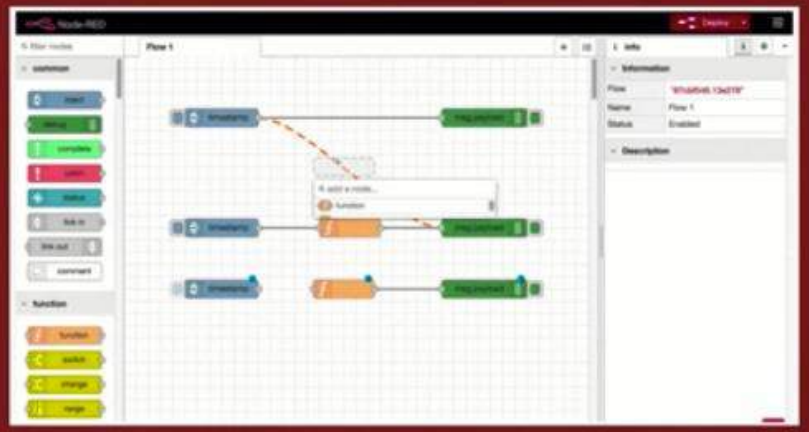

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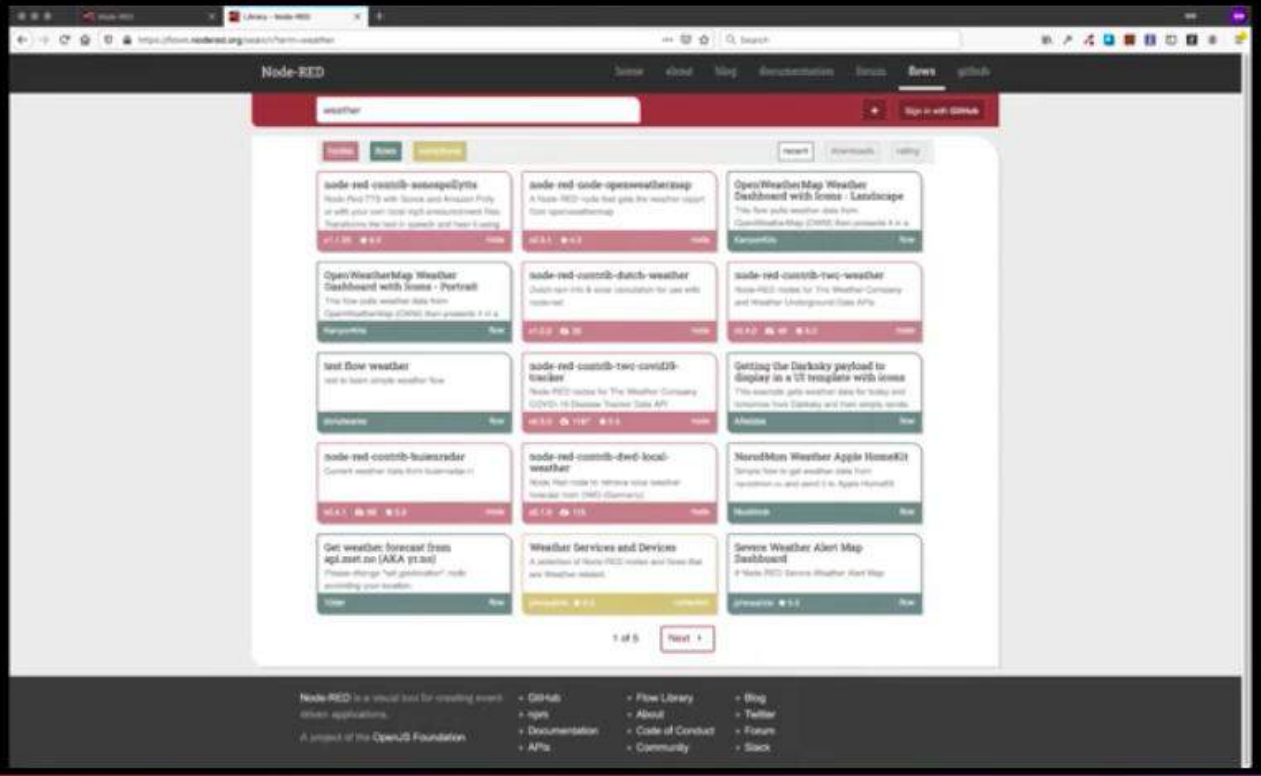
Q&A WITH SPEAKER SPEAKER BIO

Enter question here... NEW QUESTION

VIDEO



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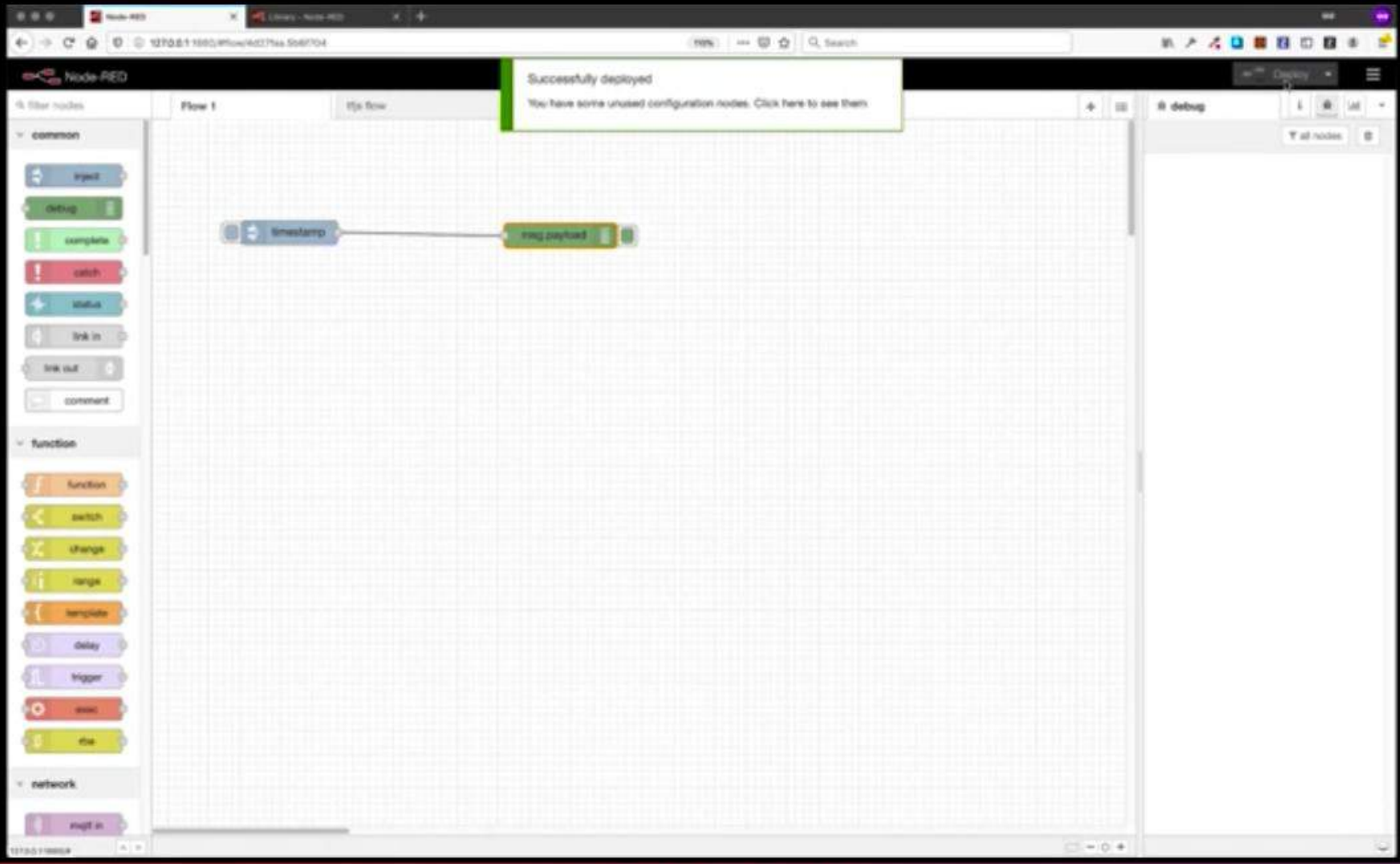

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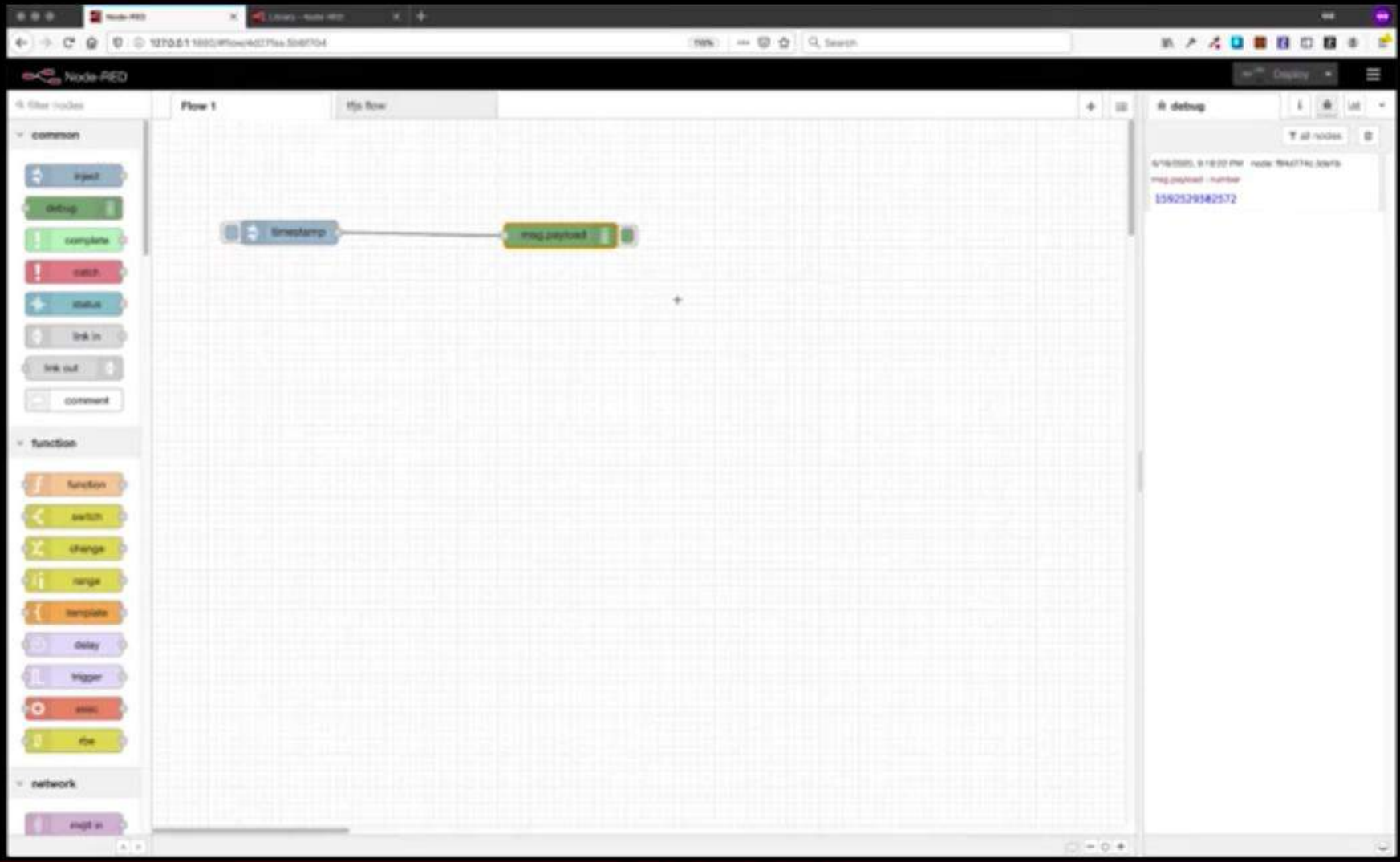

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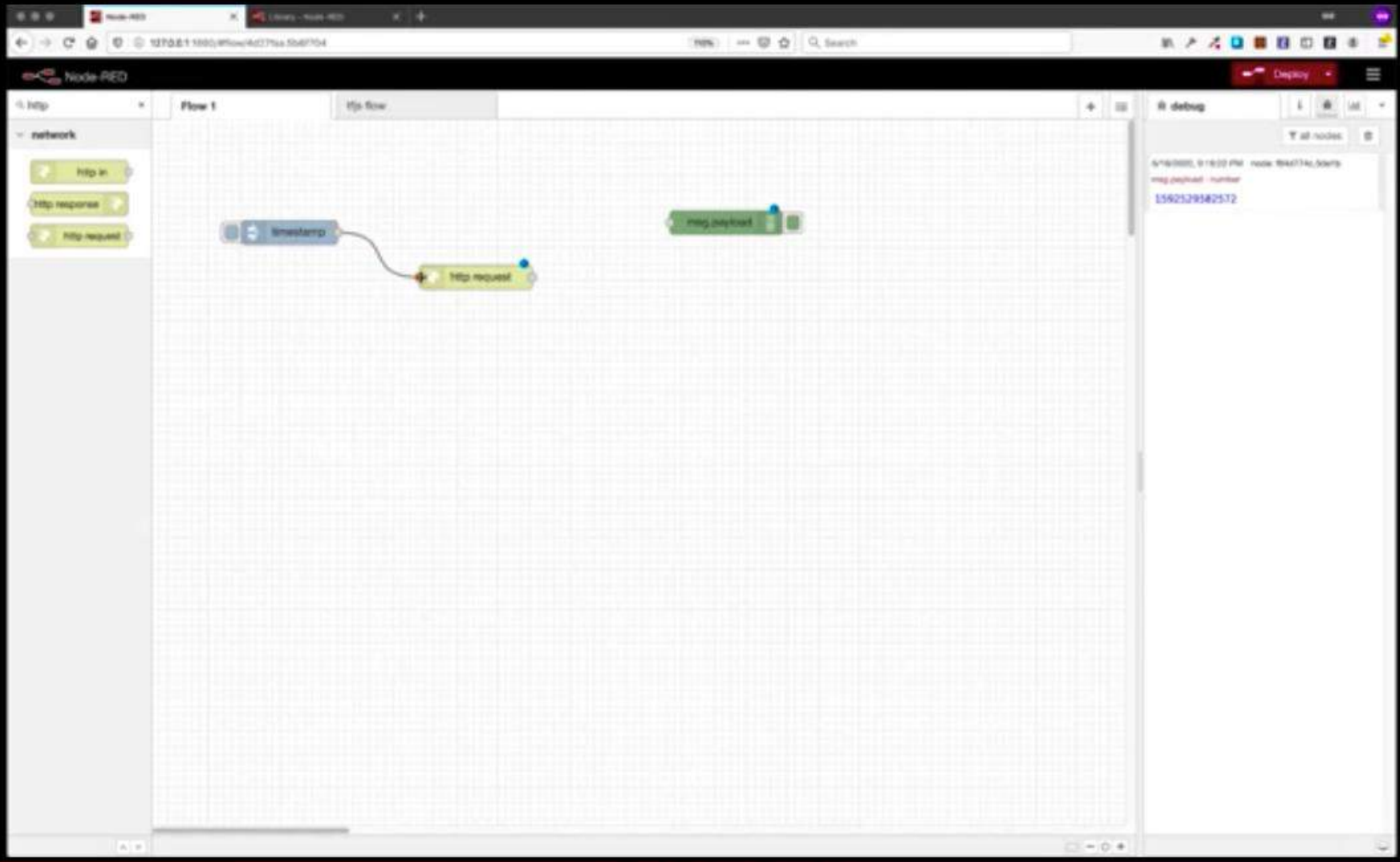

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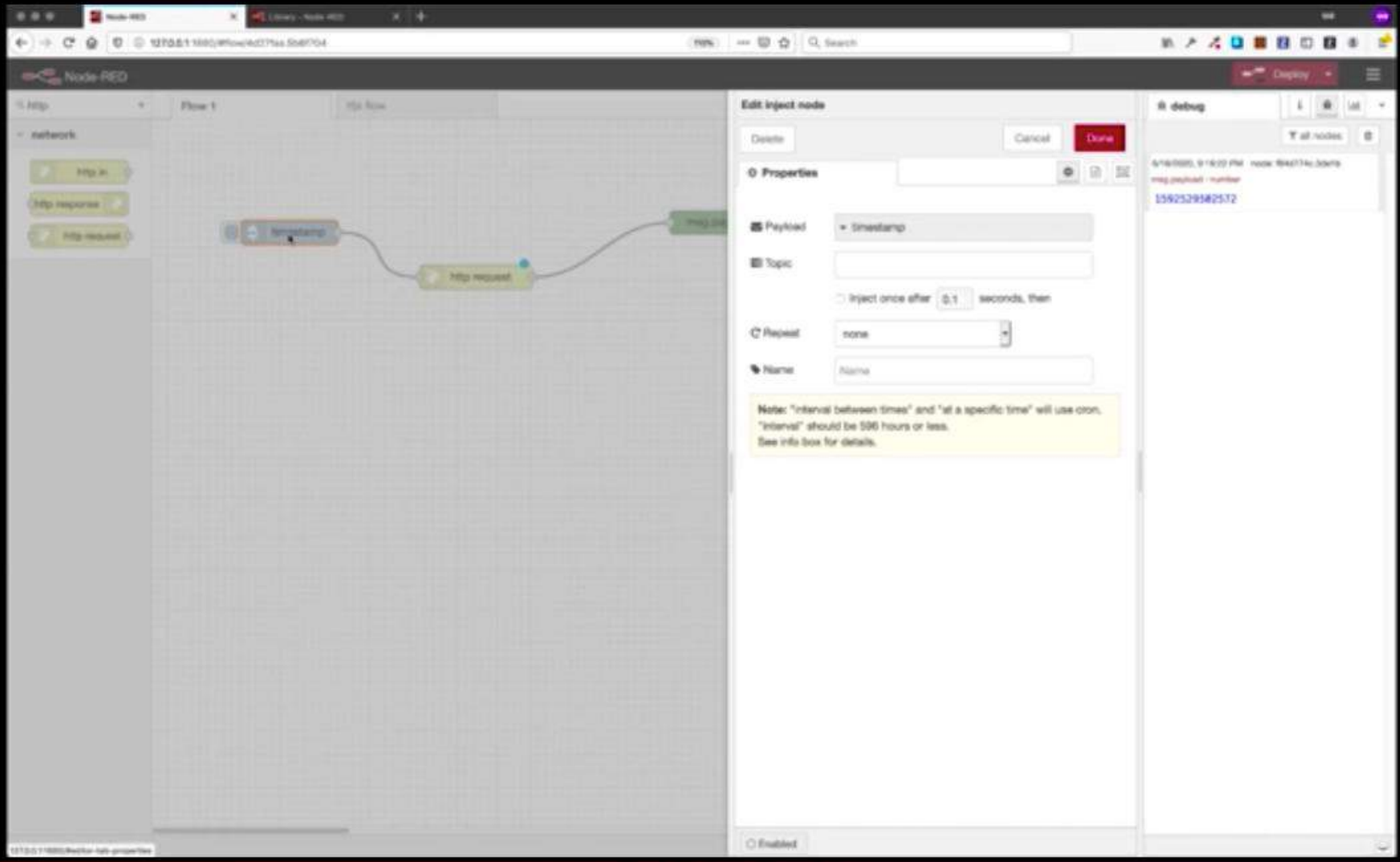

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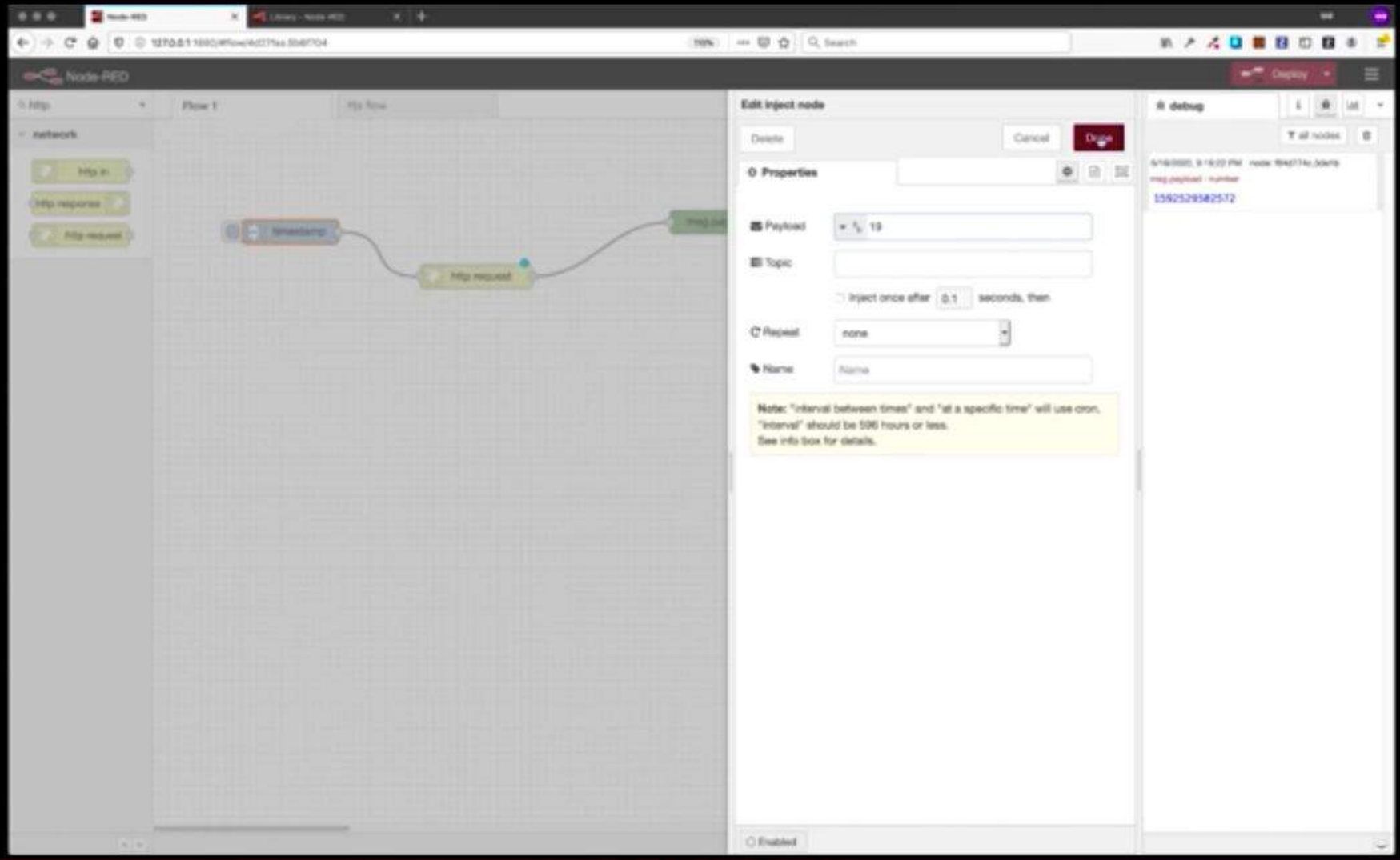

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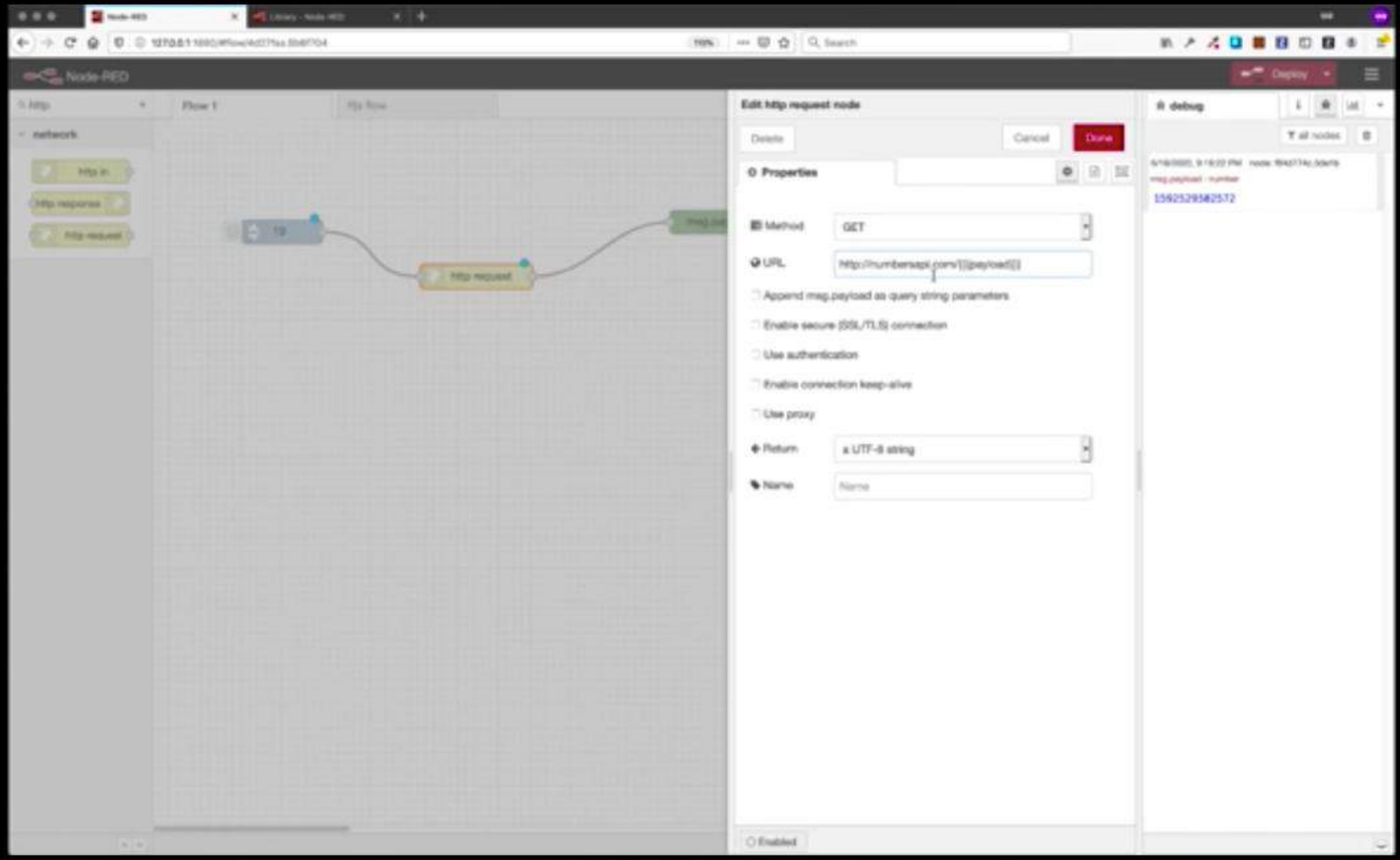

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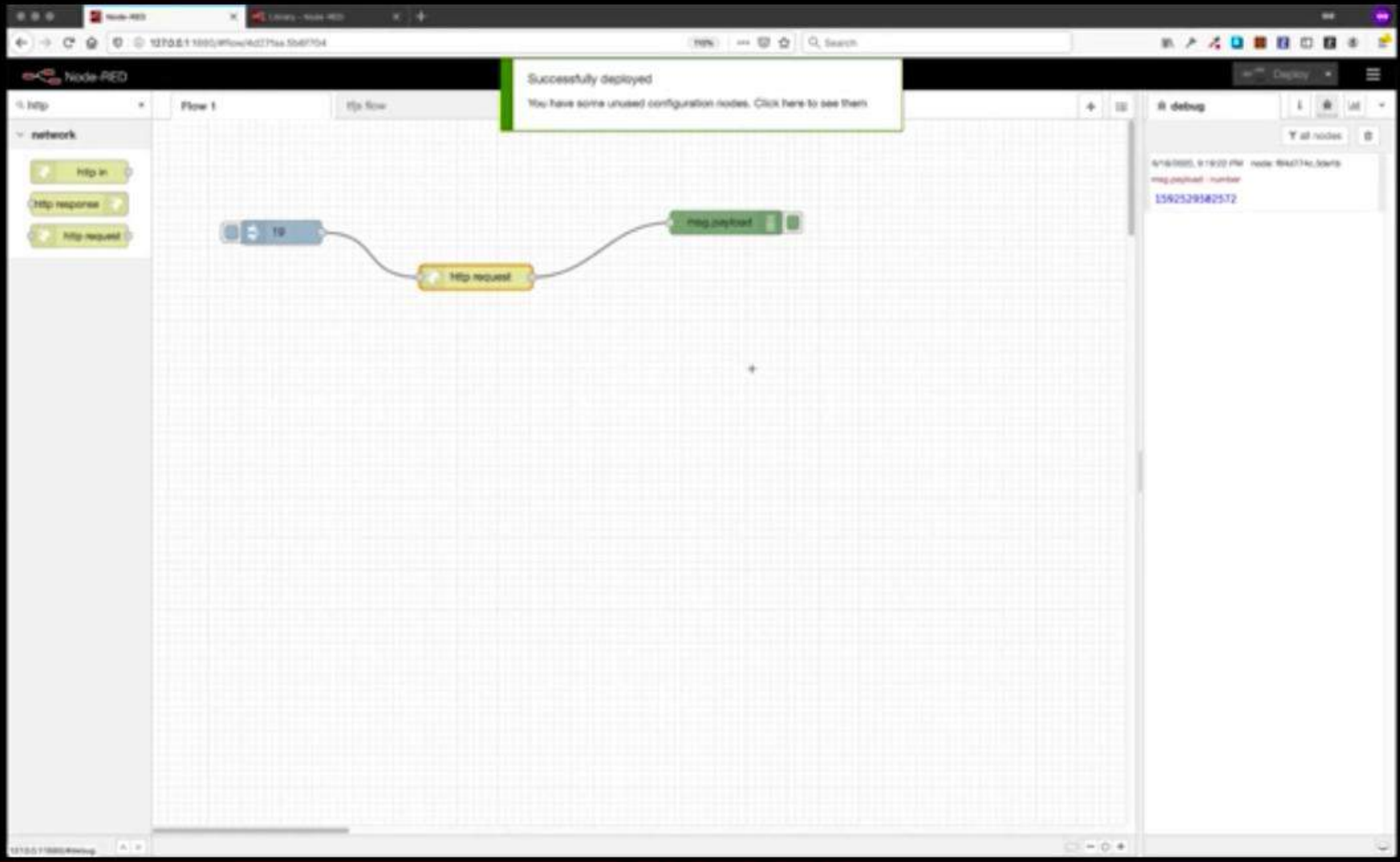

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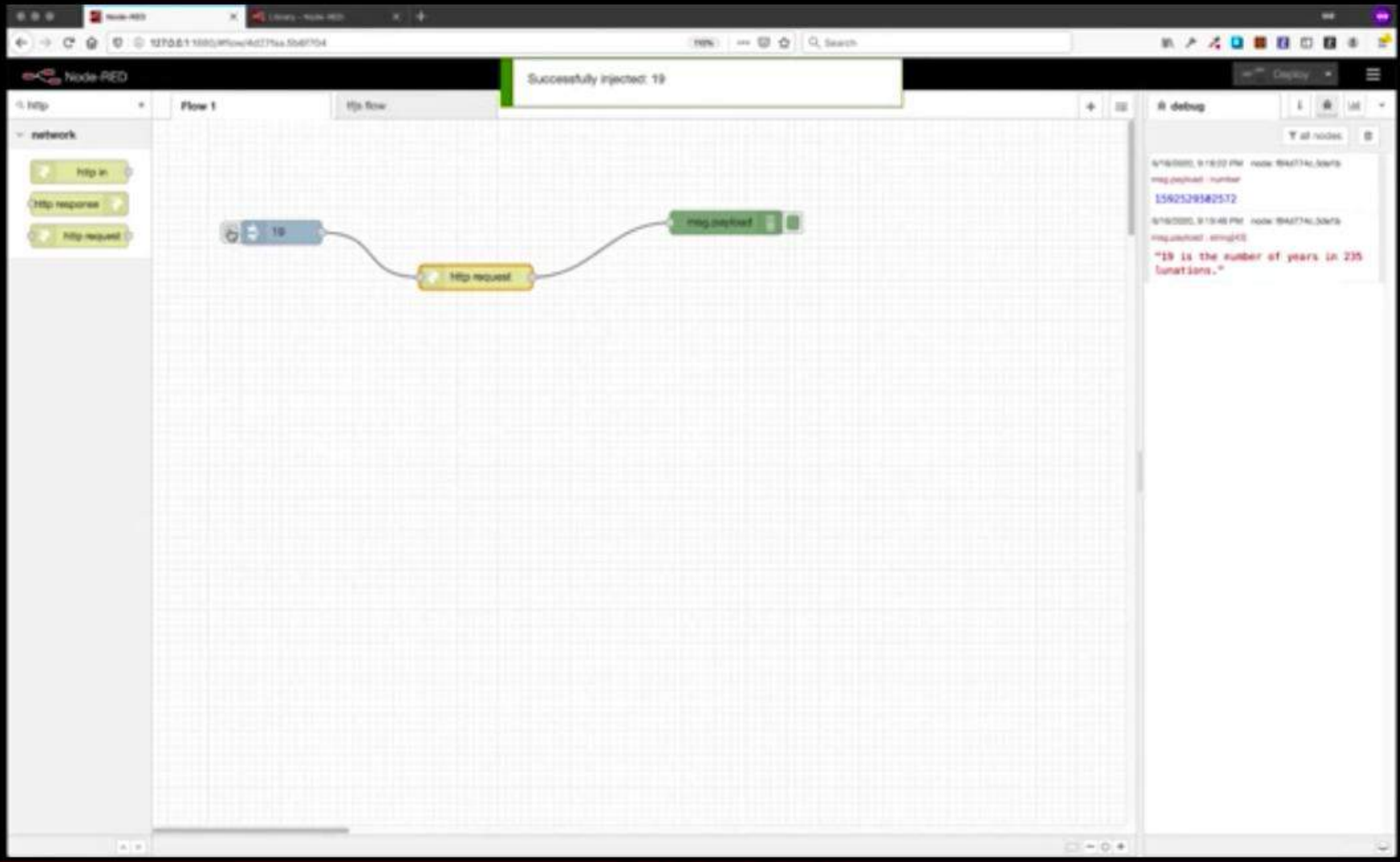

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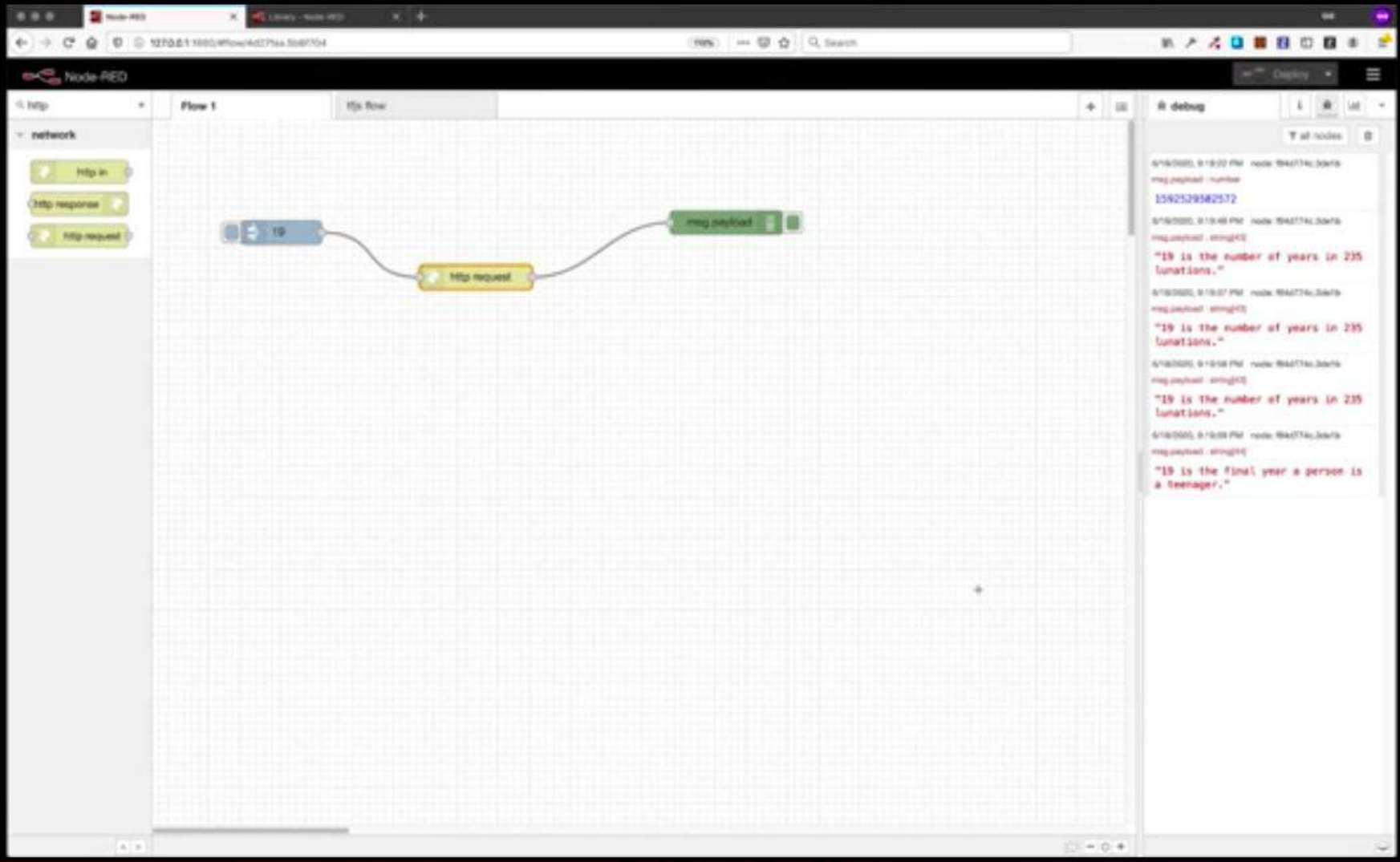

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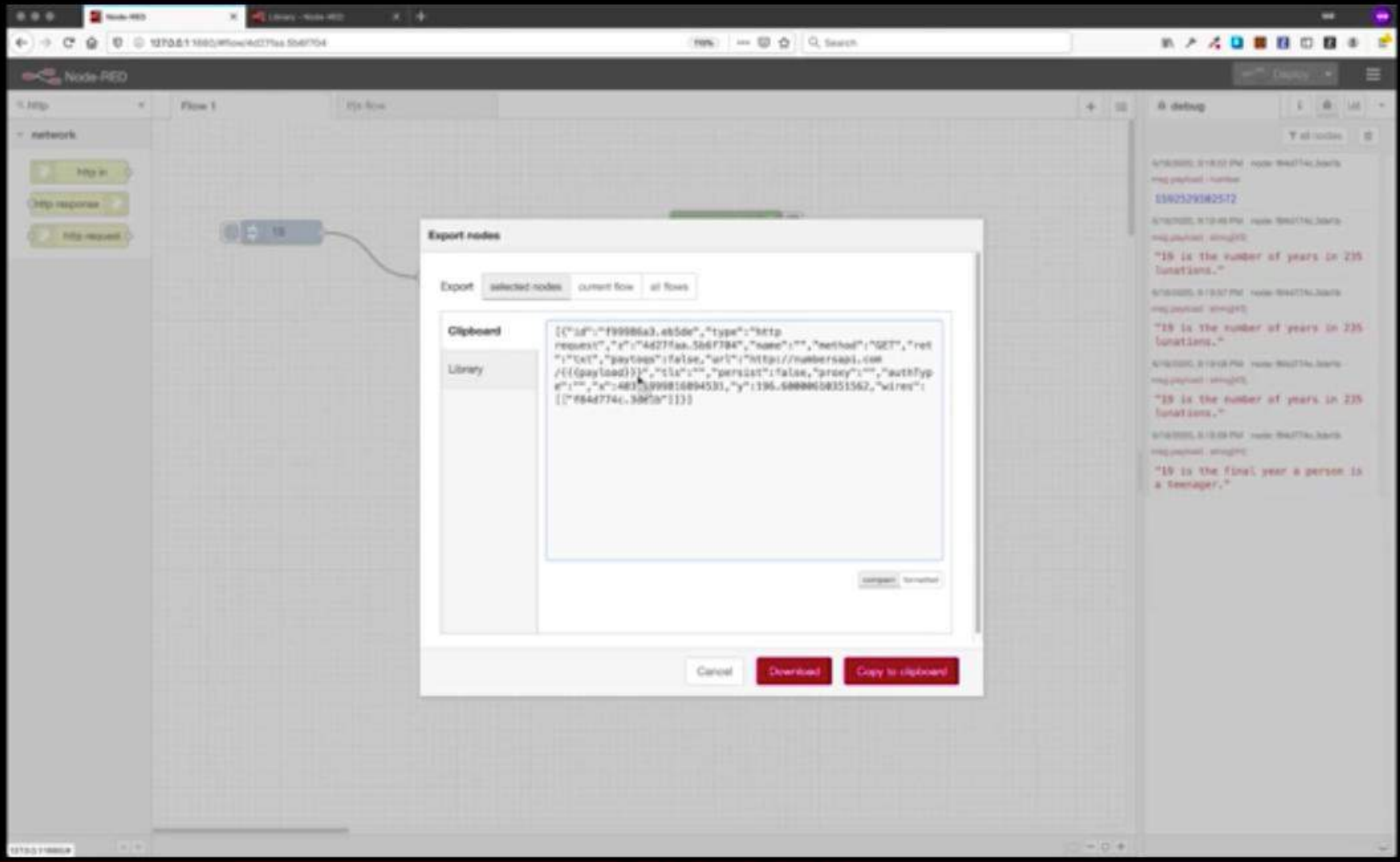

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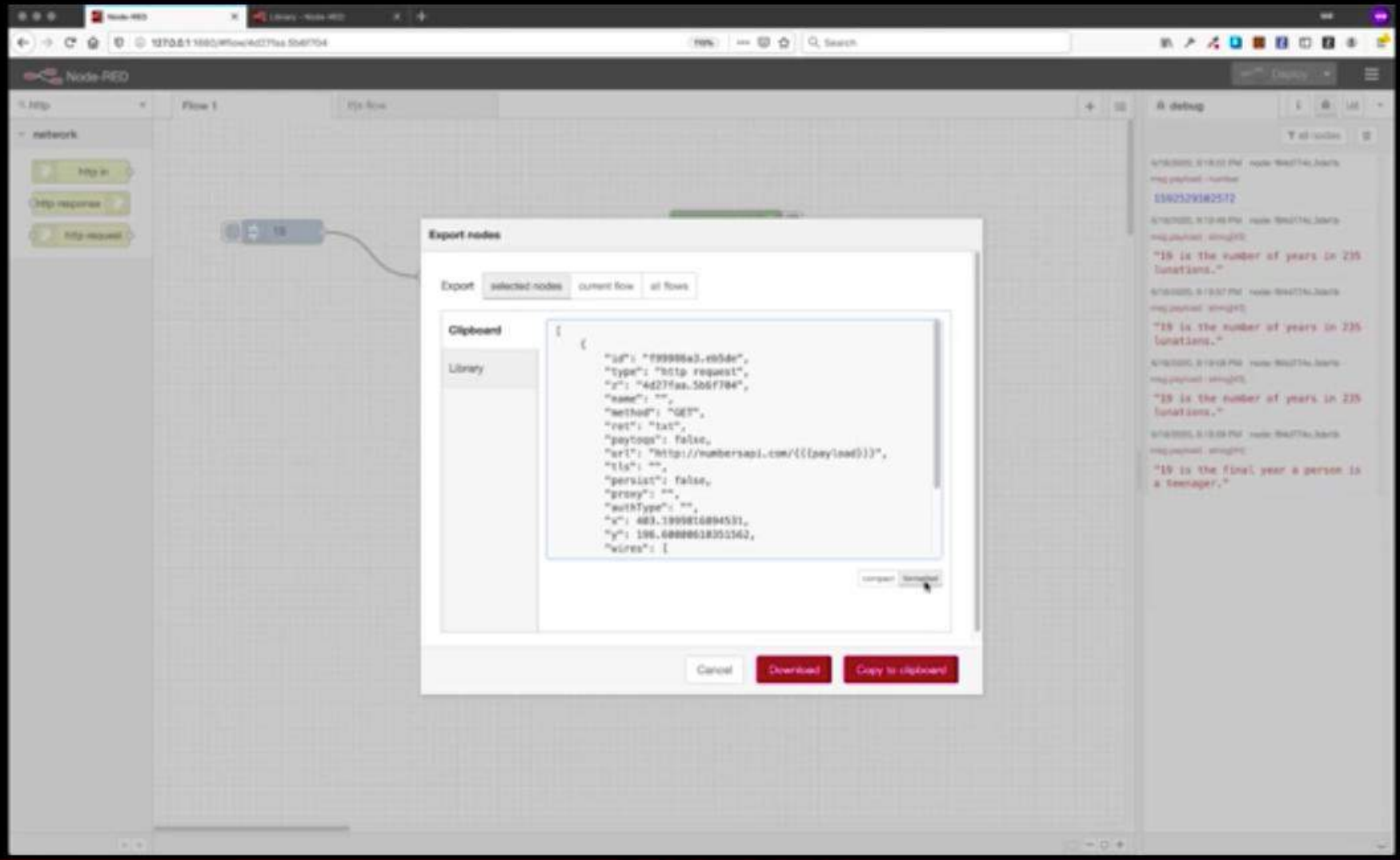

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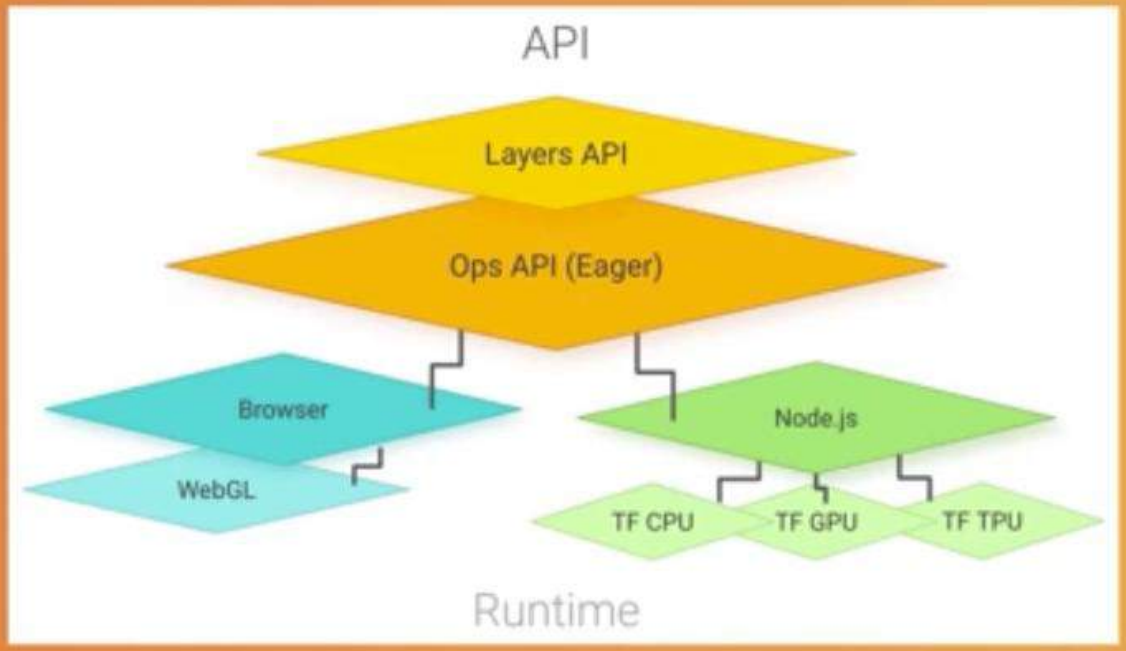

https://arxiv.org/abs/1901.05350

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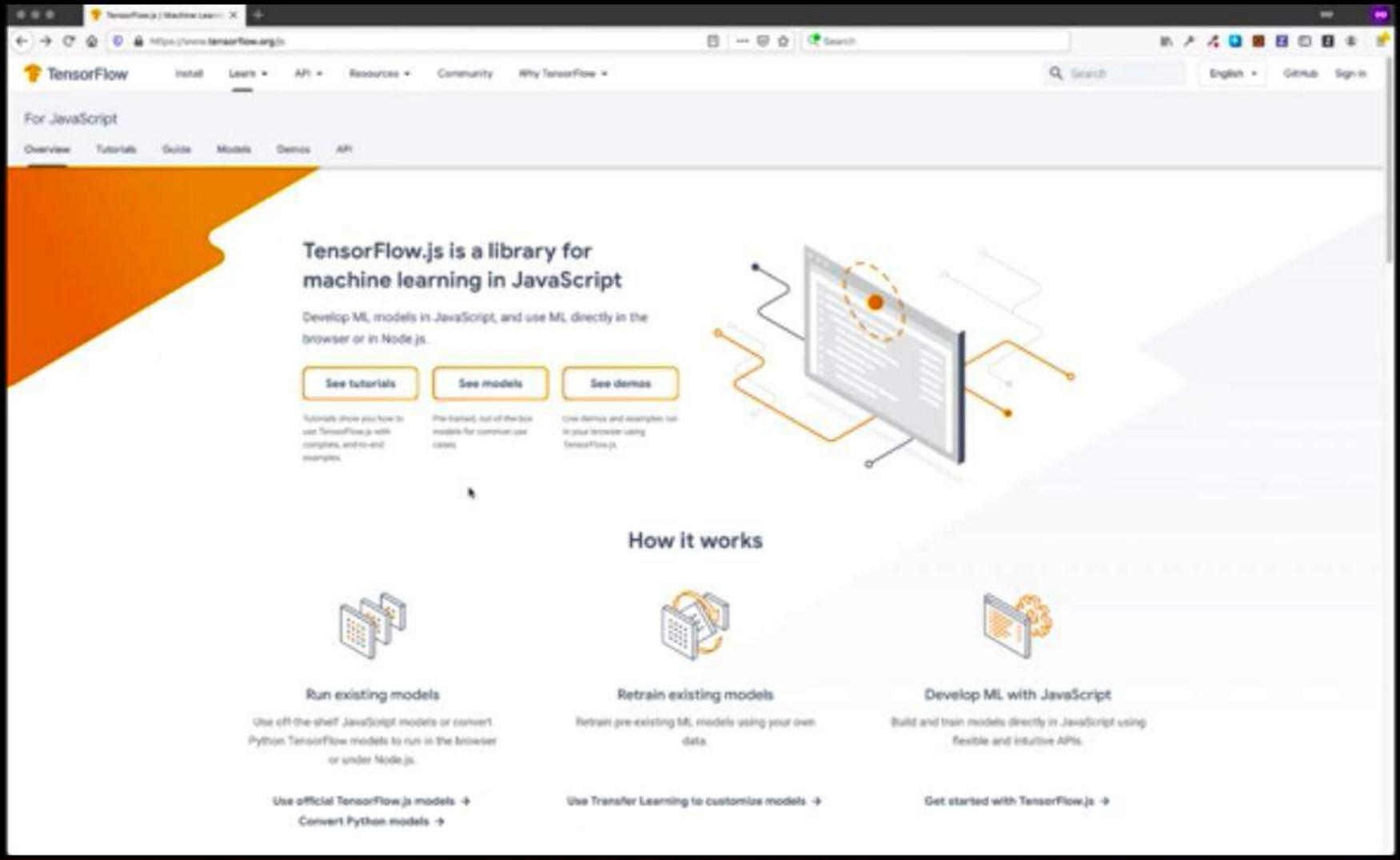

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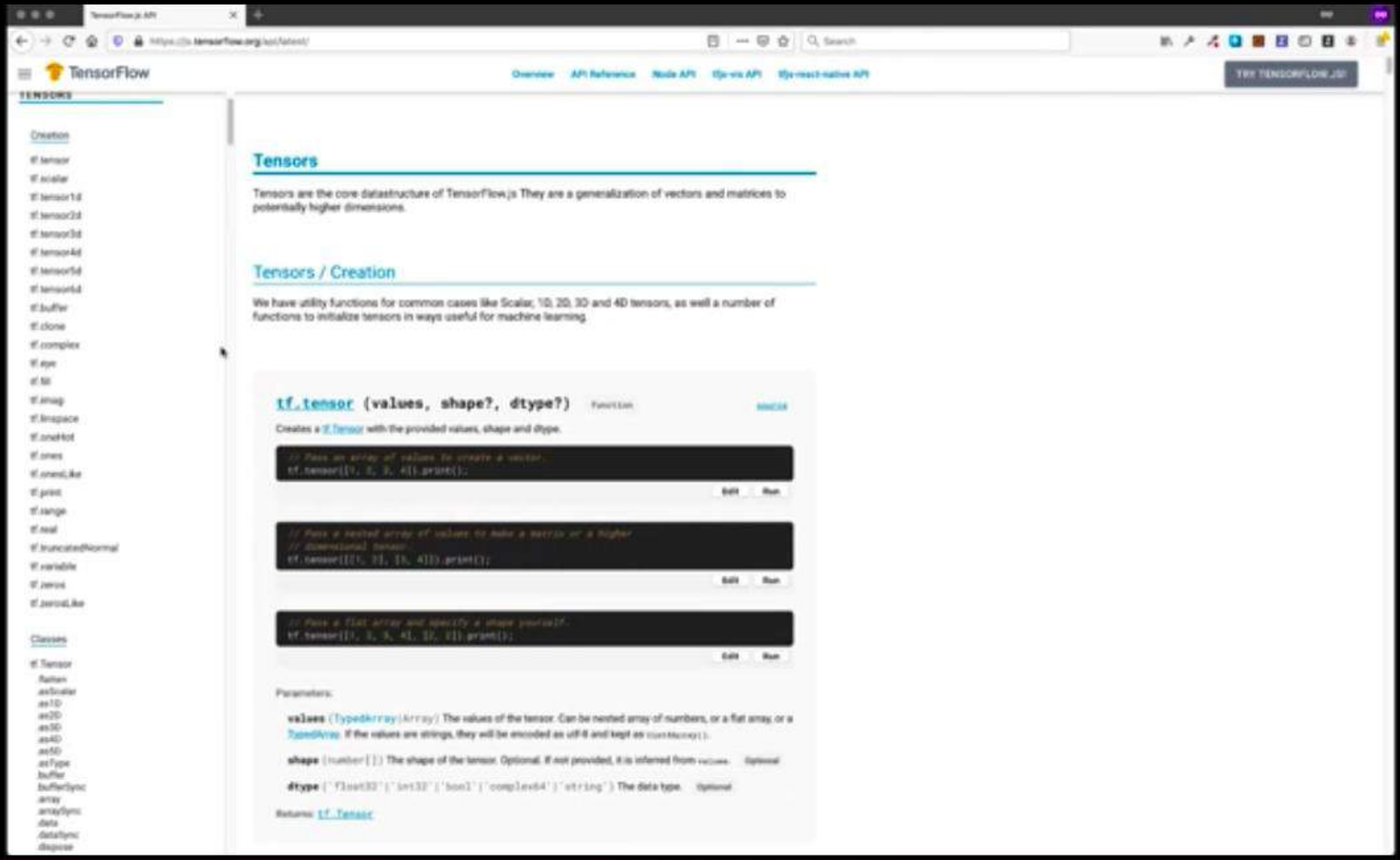

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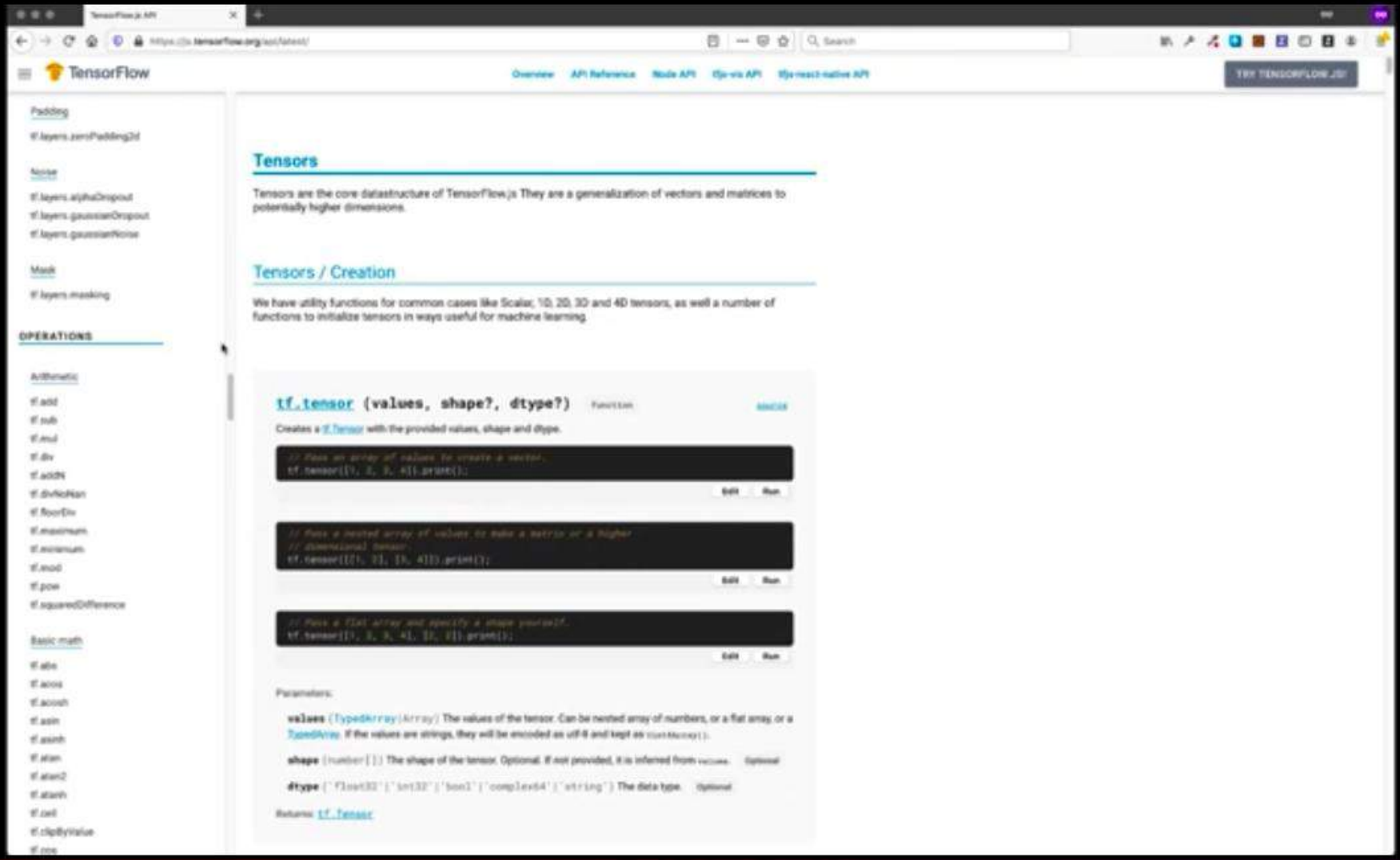

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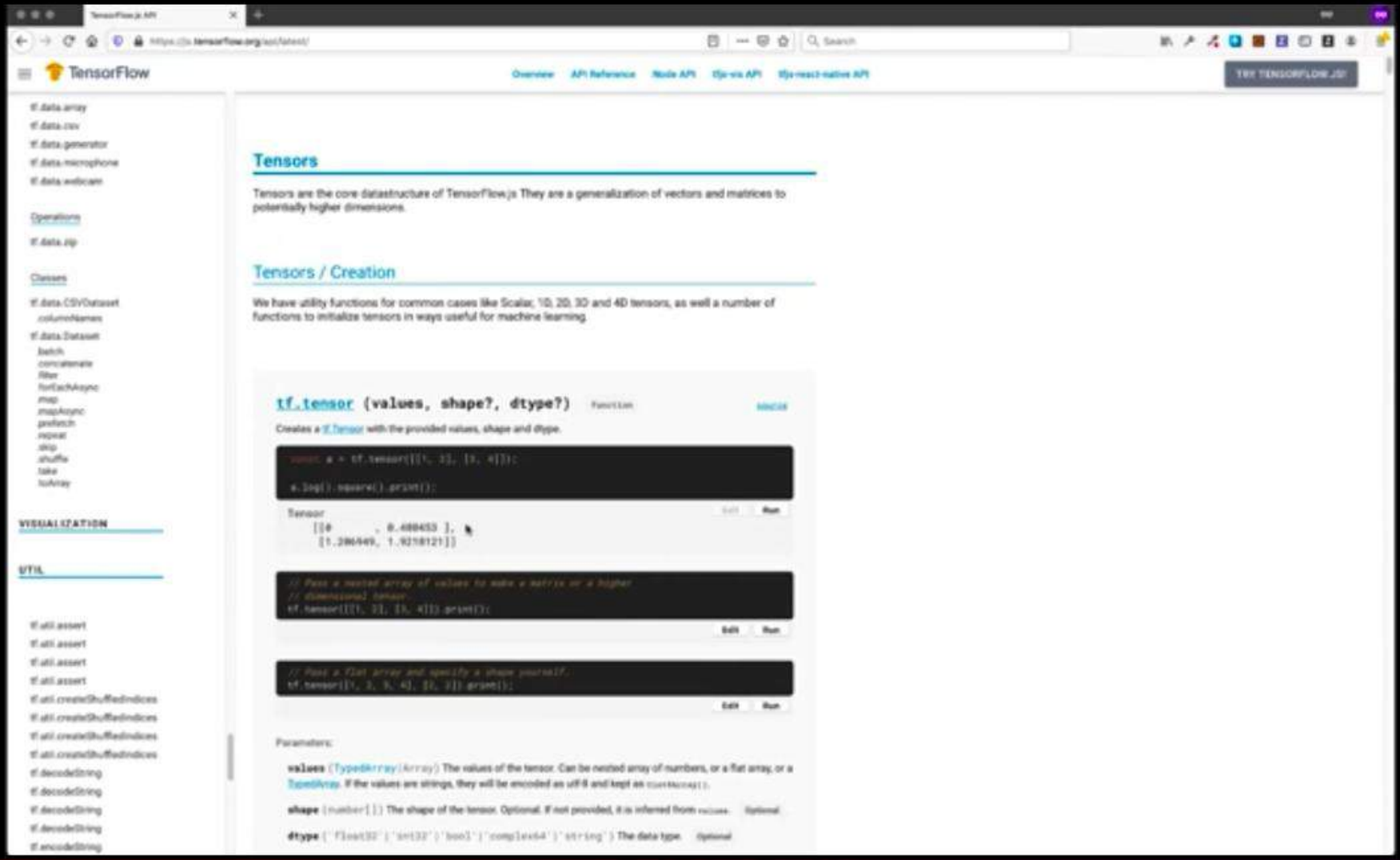

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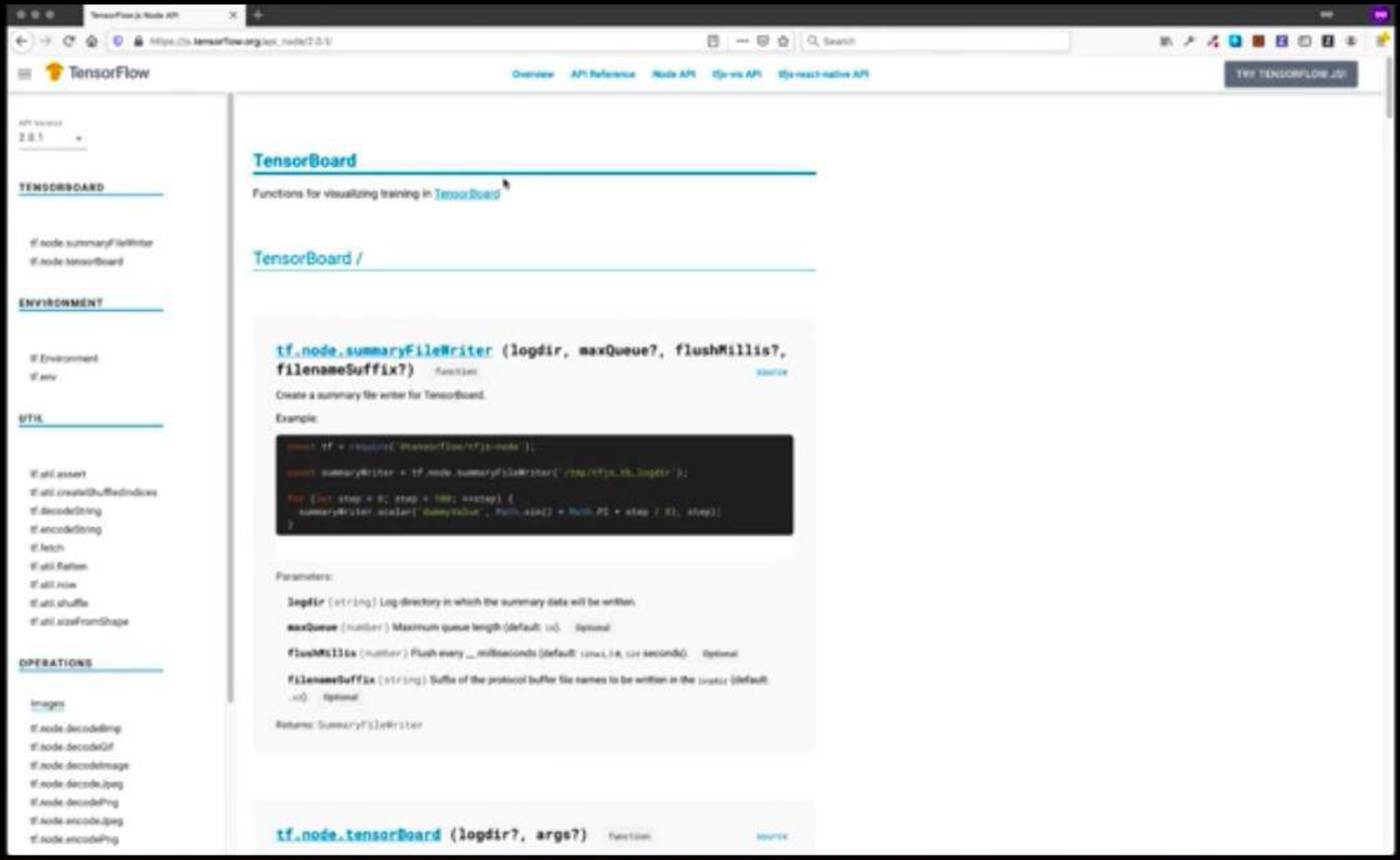

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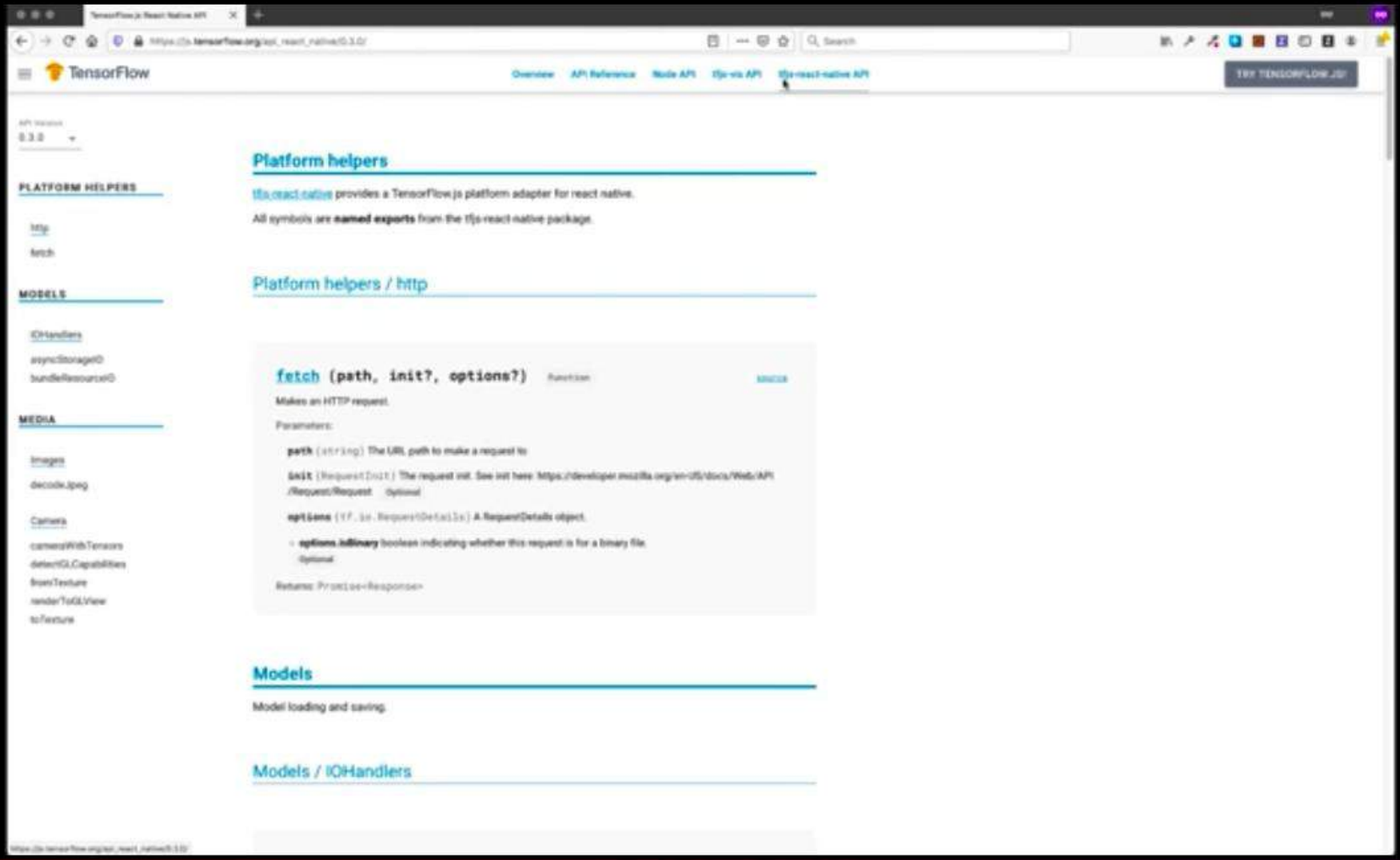

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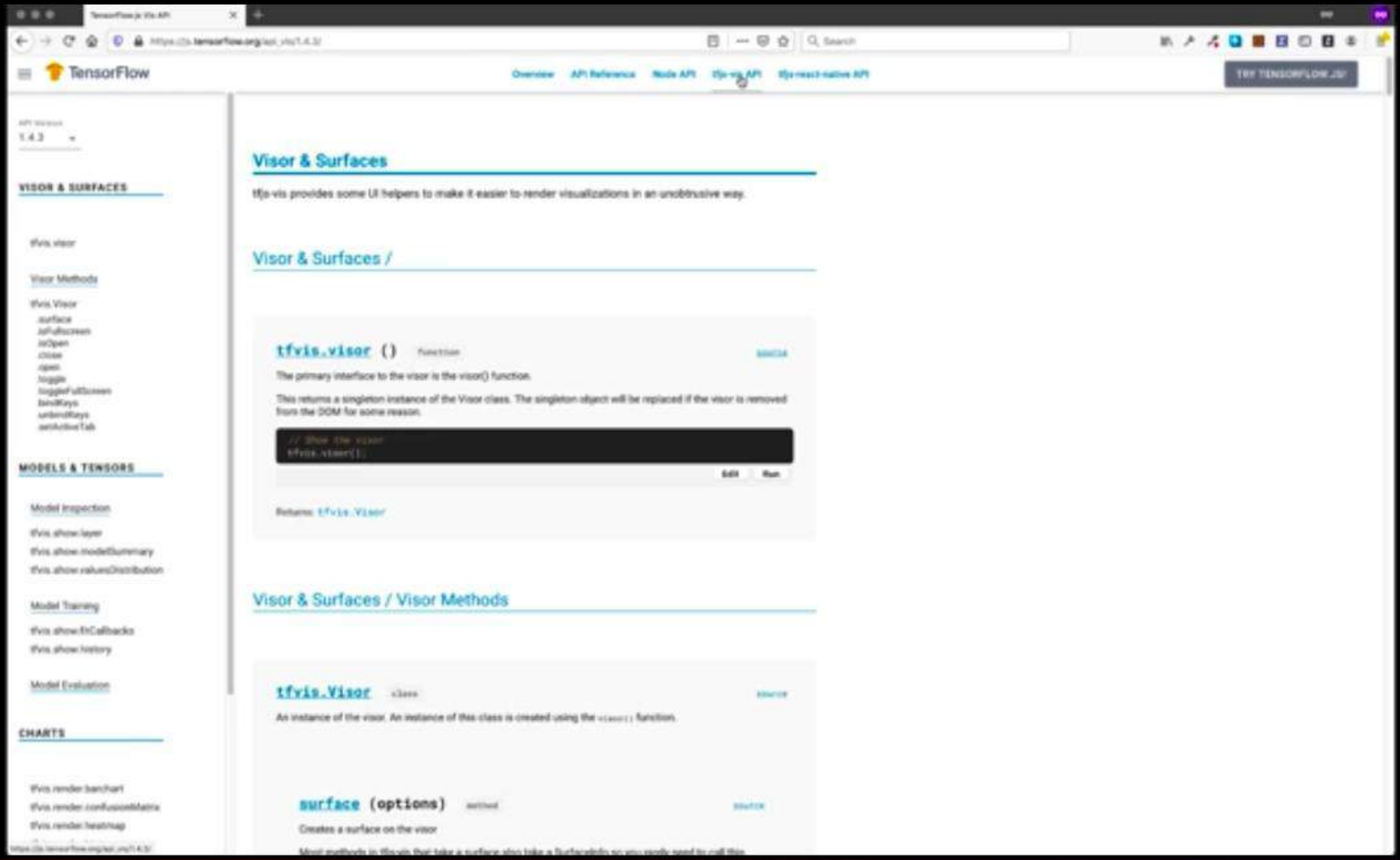

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notes.md | run-tfjs-model.js | build-model.js

getting-started-with-ai-in-node.js > src > run-tfjs-model.js > ...

```
14  // load COCO-SSD graph model from TensorFlow Hub
15  const loadModel = async function () {
16    console.log(`loading model from ${modelUrl}`);
17
18    model = await tf.loadGraphModel(modelUrl, {fromTFHub: true});
19
20    return model;
21  }
22
23  // convert image to Tensor
24  const processInput = function (imagePath) {
25    console.log(`preprocessing image ${imagePath}`);
26
27    const image = fs.readFileSync(imagePath);
28    const buf = Buffer.from(image);
29    const uint8array = new Uint8Array(buf);
30
31    return tf.node.decodeImage(uint8array, 3).expandDims();
32  }
33
34  // run prediction with the provided input Tensor
35  const runModel = function (inputTensor) {
36    console.log('runnning model');
37
38    return model.executeAsync(inputTensor);
39  }
40
41  // process the model output into a friendly JSON format
42  const processOutput = function (prediction) {
43    console.log('processOutput');
44
45    const [maxScores, classes] = extractClassesAndMaxScores(prediction[0]);
46    const indexes = calculateNMS(prediction[1], maxScores);
47
48    return createJSONresponse(prediction[1].dataSync(), maxScores, indexes, classes);
49  }
50
51  // determine the classes and max scores from the prediction
52  const extractClassesAndMaxScores = function (predictionScores) {
53    console.log('calculating classes & max scores');
```

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getting-started-with-ai-in-node.js > src > run-tfjs-model.js > ...

```
125     .then(annotatedImageBuffer => {
126       const f = path.join(path.parse(imagePath).dir, `${path.parse(imagePath).name}-annotate.png`);
127
128       fs.writeFile(f, annotatedImageBuffer, (err) => {
129         if (err) {
130           console.error(err);
131         } else {
132           console.log(`annotated image saved as ${f}\r\n`);
133         }
134       });
135     });
136 }
137
138 // run
139 if (process.argv.length < 3) {
140   console.log('please pass an image to process. ex:');
141   console.log('   node run-tfjs-model.js /path/to/image.jpg');
142 } else {
143   // e.g., /path/to/image.jpg
144   let imagePath = process.argv[2];
145
146   loadModel().then(model  const processInput: (imagePath: any) => any
147     const inputTensor = processInput(imagePath);
148     height = inputTensor.shape[1];
149     width = inputTensor.shape[2];
150     return runModel(inputTensor);
151   }).then(prediction => {
152     const jsonOutput = processOutput(prediction);
153     console.log(jsonOutput);
154     annotateImage(jsonOutput, imagePath);
155   })
156 }
157
```

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notes.md | run-tfjs-model.js | build-model.js

coding-a-deep-learning-model-using-tensorflow-javascript > src > build-model.js > buildModel

```
// Define the model architecture
const buildModel = function () {
  const model = tf.sequential();

  // add the model layers
  model.add(tf.layers.conv2d({
    inputShape: [imageWidth, imageHeight, imageChannels],
    filters: 8,
    kernelSize: 5,
    padding: 'same',
    activation: 'relu'
  }));
  model.add(tf.layers.maxPooling2d({
    poolSize: 2,
    strides: 2
  }));
  model.add(tf.layers.conv2d({
    filters: 16,
    kernelSize: 5,
    padding: 'same',
    activation: 'relu'
  }));
  model.add(tf.layers.maxPooling2d({
    poolSize: 3,
    strides: 3
  }));
  model.add(tf.layers.flatten());
  model.add(tf.layers.dense({
    units: numOfClasses,
    activation: 'softmax'
  }));

  // compile the model
  model.compile({
    optimizer: 'adam',
    loss: 'categoricalCrossentropy',
    metrics: ['accuracy']
  });

  return model;
```

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Node-RED with TensorFlow.js

Why bring TF.js to Node-RED?

ML to IoT with ease

- Intuitive visual programming model
- Lower barrier to entry

Privacy

- Data security
- Data does not leave device

Network

- Offline
- Low bandwidth
- Remote locations

flows.nodered.org / GitHub

node-red-contrib-tf-model

custom Node-RED node to retrieve/execute a Tensorflow model

node-red-contrib-tf-function

Node-RED custom node which mimic the original function node but provide tf in the global context

node-red-contrib-bert-tokenizer

Node-RED module to implement bert-tokenizer

node-red-contrib-post-object-detection

Node-RED module to handle prediction results of an object detection model.

Node-RED TFJS Object Detection

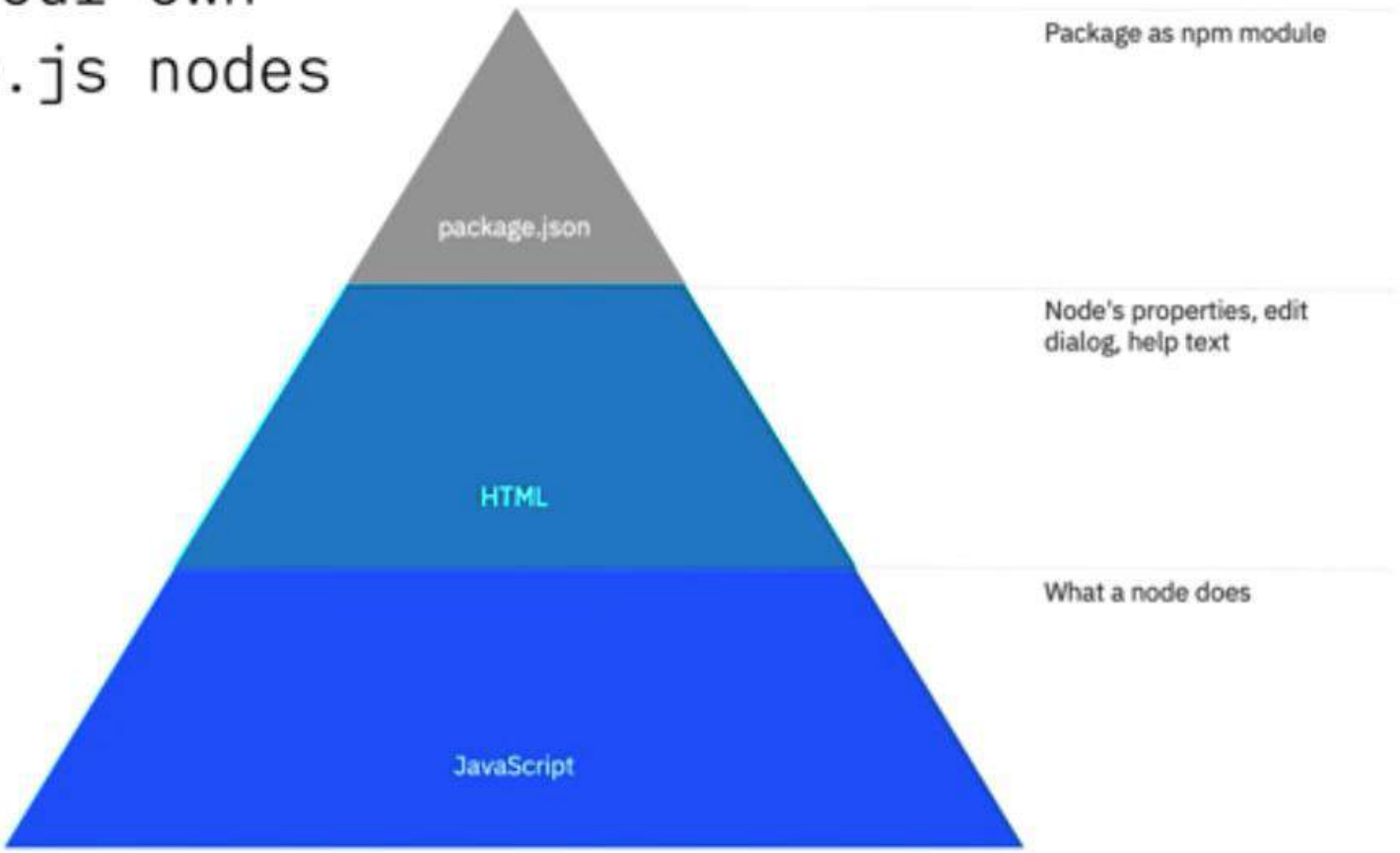
Node-RED module for TensorFlow.js object detection model

Node-RED for ML with TFJS

Node-RED nodes with TensorFlow.js to enable machine learning in Node-RED

... and more

Creating your own TensorFlow.js nodes



https://medium.com/codait/a-low-code-approach-to-incorporating-machine-learning-into-your-iot-device-24f3f2a70717

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notes.md | package.json | index.html | index.js

building-a-machine-learning-node-for-node-red-using-tensorflow.js > src > nodered-dev > node-red-contrib-tfjs-tutorial > package.json > ...

```
{
  "name": "node-red-contrib-tfjs-tutorial",
  "version": "0.0.1",
  "description": "Example of custom Node-RED with TensorFlow.js",
  "main": "index.js",
  "scripts": {
    "test": "echo \"Error: no test specified\" && exit 1"
  },
  "author": "",
  "license": "Apache-2.0",
  "peerDependencies": {
    "@tensorflow/tfjs-node": "^1.7.2"
  },
  "node-red": {
    "nodes": {
      "tfjs-tutorial-node": "index.js"
    }
  }
}
```

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building-a-machine-learning-node-for-node-red-using-tensorflow.js > src > nodered-dev > node-red-contrib-tfjs-tutorial > index.html > script

```
<script type="text/html" data-template-name="tfjs-tutorial-node">
  <div class="form-row">
    <label for="node-input-name"><i class="fa fa-tag"></i> Name</label>
    <input type="text" id="node-input-name" placeholder="Name">
  </div>
  <div class="form-row">
    <label for="node-input-modelUrl"><i class="fa fa-globe"></i> Model Url</label>
    <input type="text" id="node-input-modelUrl" placeholder="https://modelurl/model.json">
  </div>
  <div class="form-row">
    <label for="node-input-fromHub">Is TFHub?</label>
    <input type="checkbox" id="node-input-fromHub" checked>
  </div>
</script>

<script type="text/javascript">
  RED.nodes.registerType('tfjs-tutorial-node', {
    category: 'machine learning',
    defaults: {
      name: { value: 'tfjs tutorial node' },
      modelUrl: { value: 'https://tfhub.dev/tensorflow/tfjs-model/ssdlite_mobilenet_v2/1/default/1' },
      fromHub: { value: 'checked' }
    },
    inputs: 1,
    outputs: 1,
    paletteLabel: 'tfjs tutorial node',
    color: '#ff9100',
    label: function() {
      return this.name || 'tfjs tutorial node';
    }
  });
</script>

<script type="text/html" data-help-name="tfjs-tutorial-node">
  <p>A TensorFlow.js node to run prediction using the Coco SSD model for object detection.</p>
  <p>Provide a <strong>Model Url</strong> and indicate whether the URL points to a TFHub hosted model.</p>
  <p>The node accepts a image buffer and outputs a JSON prediction object with detected objects and their bounding box and confidence sc
</script>
```

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notes.md package.json index.html index.js

building-a-machine-learning-node-for-node-red-using-tensorflow.js > src > nodered-dev > node-red-contrib-tfjs-tutorial > index.html > script

```
    </div>
    <div class="form-row">
      <label for="node-input-fromHub">Is TFHub?</label>
      <input type="checkbox" id="node-input-fromHub" checked>
    </div>
</script>

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    category: 'machine learning',
    defaults: {
      name: { value: 'tfjs tutorial node' },
      modelUrl: { value: 'https://tfhub.dev/tensorflow/tfjs-model/ssdlite_mobilenet_v2/1/default/1' },
      fromHub: { value: 'checked' }
    },
    inputs: 1,
    outputs: 1,
    paletteLabel: 'tfjs tutorial node',
    color: '#ff9100',
    label: function() {
      return this.name || 'tfjs tutorial node';
    }
  });
</script>

<script type="text/html" data-help-name="tfjs-tutorial-node">
    <p>A TensorFlow.js node to run prediction using the Coco SSD model for object detection.</p>
    <p>Provide a <strong>Model Url</strong> and indicate whether the URL points to a TFHub hosted model.</p>
    <p>The node accepts a image buffer and outputs a JSON prediction object with detected objects and their bounding box and confidence score.</p>
</script>
```

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notes.md package.json index.html index.js

building-a-machine-learning-node-for-node-red-using-tensorflow.js > src > nodered-dev > node-red-contrib-tfjs-tutorial > index.js > <unknown> > exports > TfjsTutorialNode > node.on('input') callback

```
module.exports = function(RED) {
  // import helper module
  const tfutil = require('./tfjs-tutorial-util.js');

  // load the model
  async function loadModel (config, node) {
    node.model = await tfutil.loadModel(config.modelUrl, config.fromHub);
  }

  // define the node's behavior
  function TfjsTutorialNode(config) {
    // initialize the features
    RED.nodes.createNode(this, config);
    const node = this

    loadModel(config, node)

    // register a listener to get called whenever a message arrives at the node
    node.on('input', function (msg) {
      // preprocess the incoming image
      const inputTensor = tfutil.processInput(msg.payload);
      // get image/input shape
      const height = inputTensor.shape[1];
      const width = inputTensor.shape[2];

      // get the prediction
      node.model
        .executeAsync(inputTensor)
        .then(prediction => {
          msg.payload = tfutil.processOutput(prediction, height, width);
          // send the prediction out
          node.send(msg);
        });
    });
  }

  // register the node with the runtime
  RED.nodes.registerType('tfjs-tutorial-node', TfjsTutorialNode);
}
```

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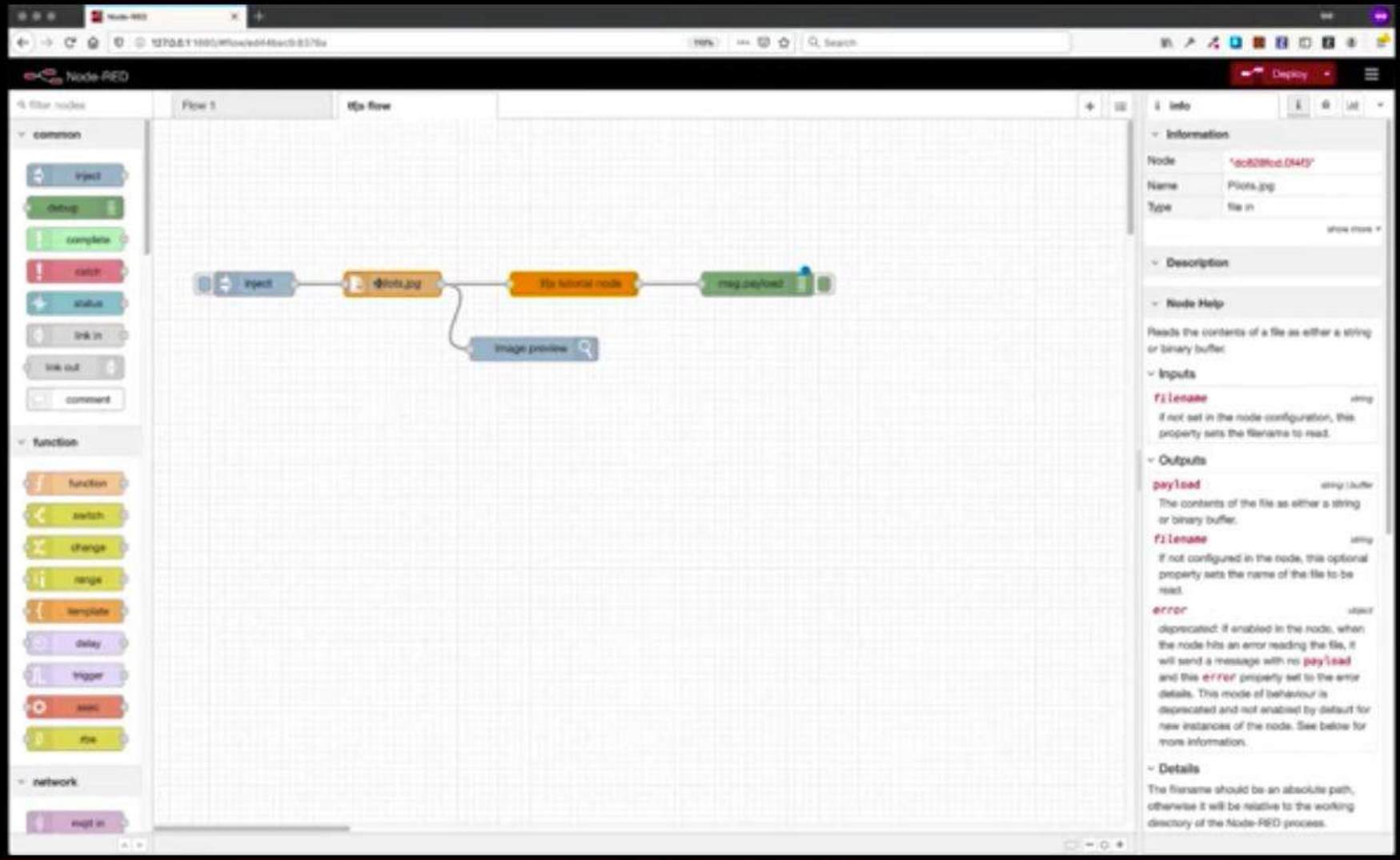

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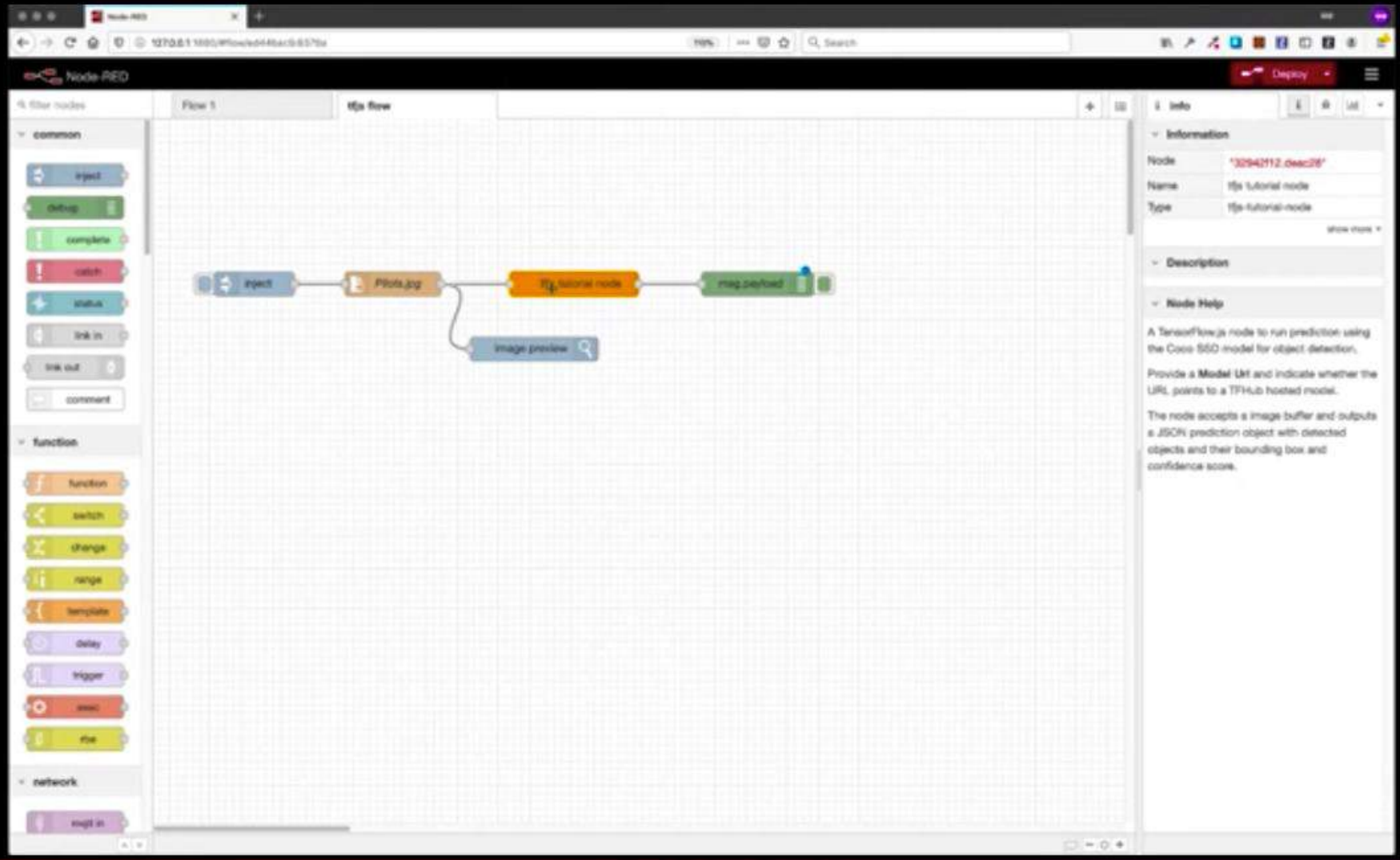

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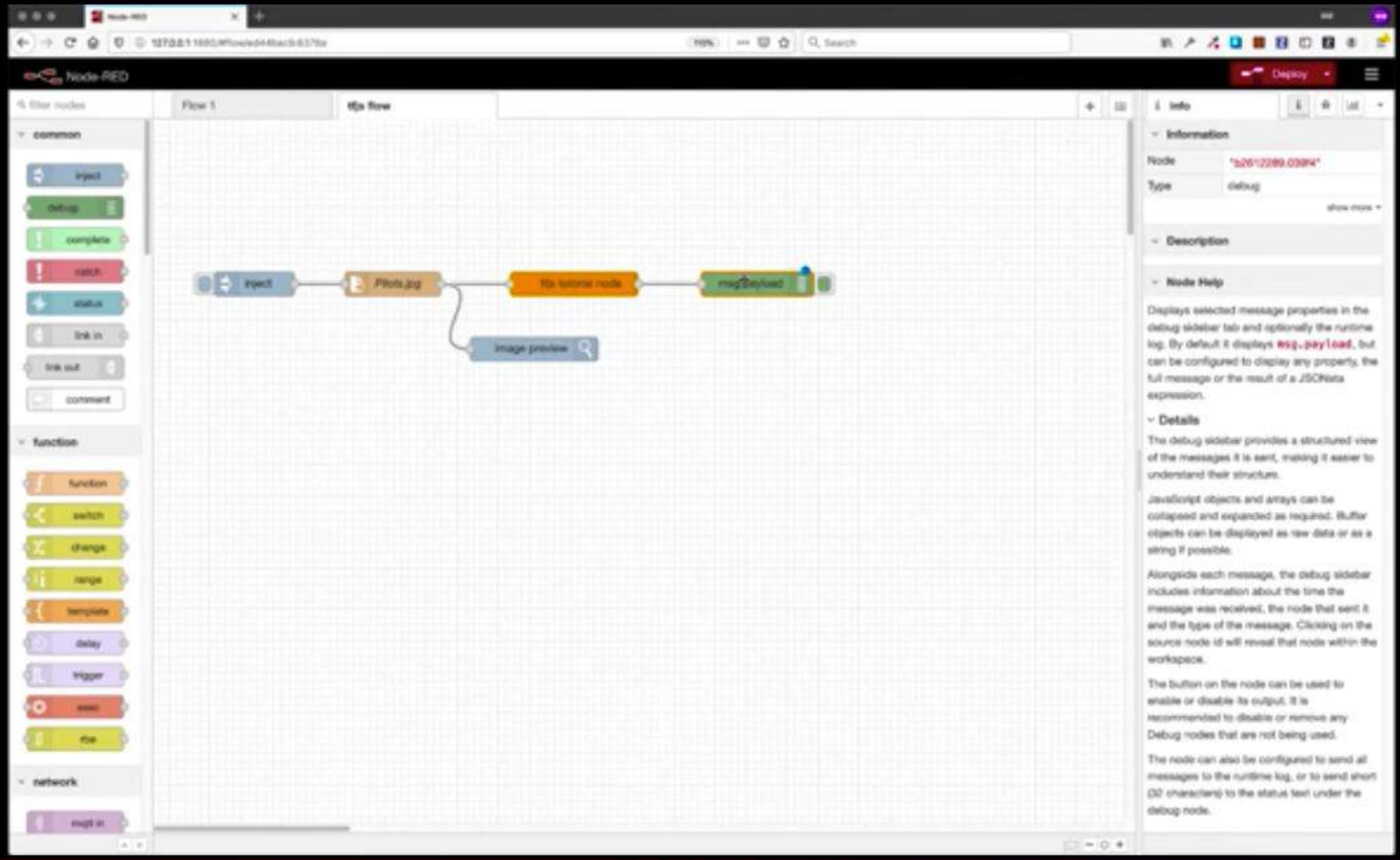

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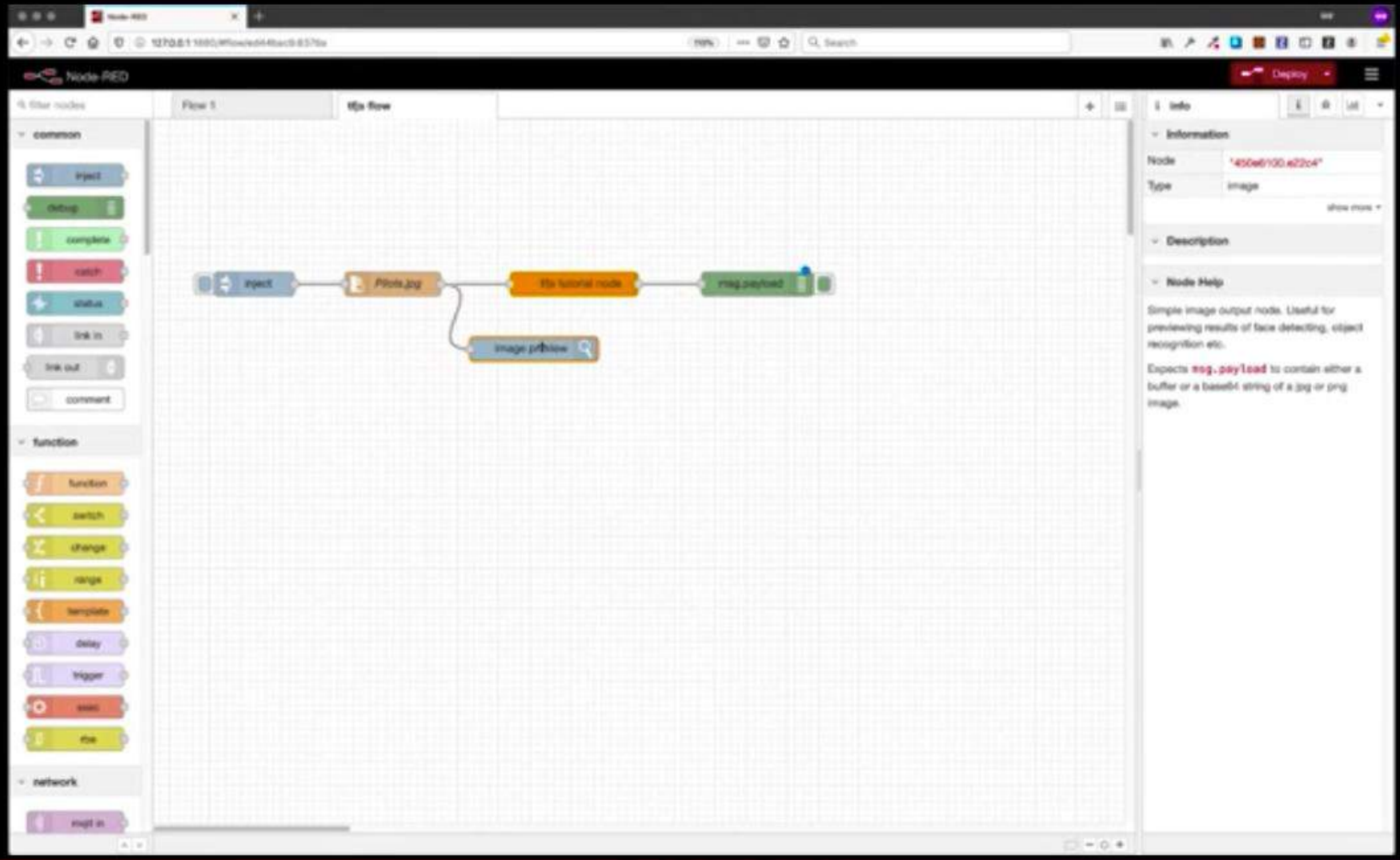

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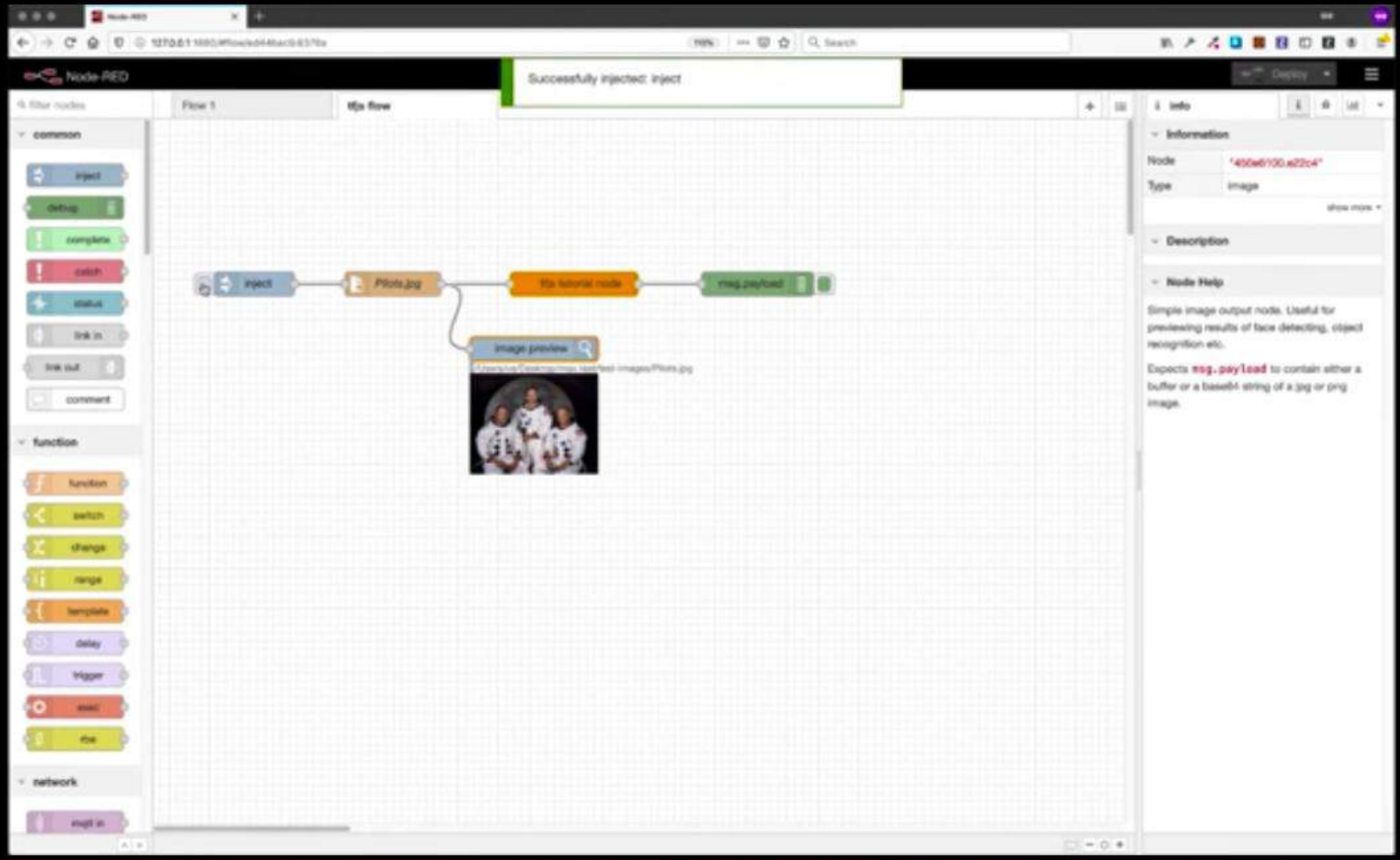

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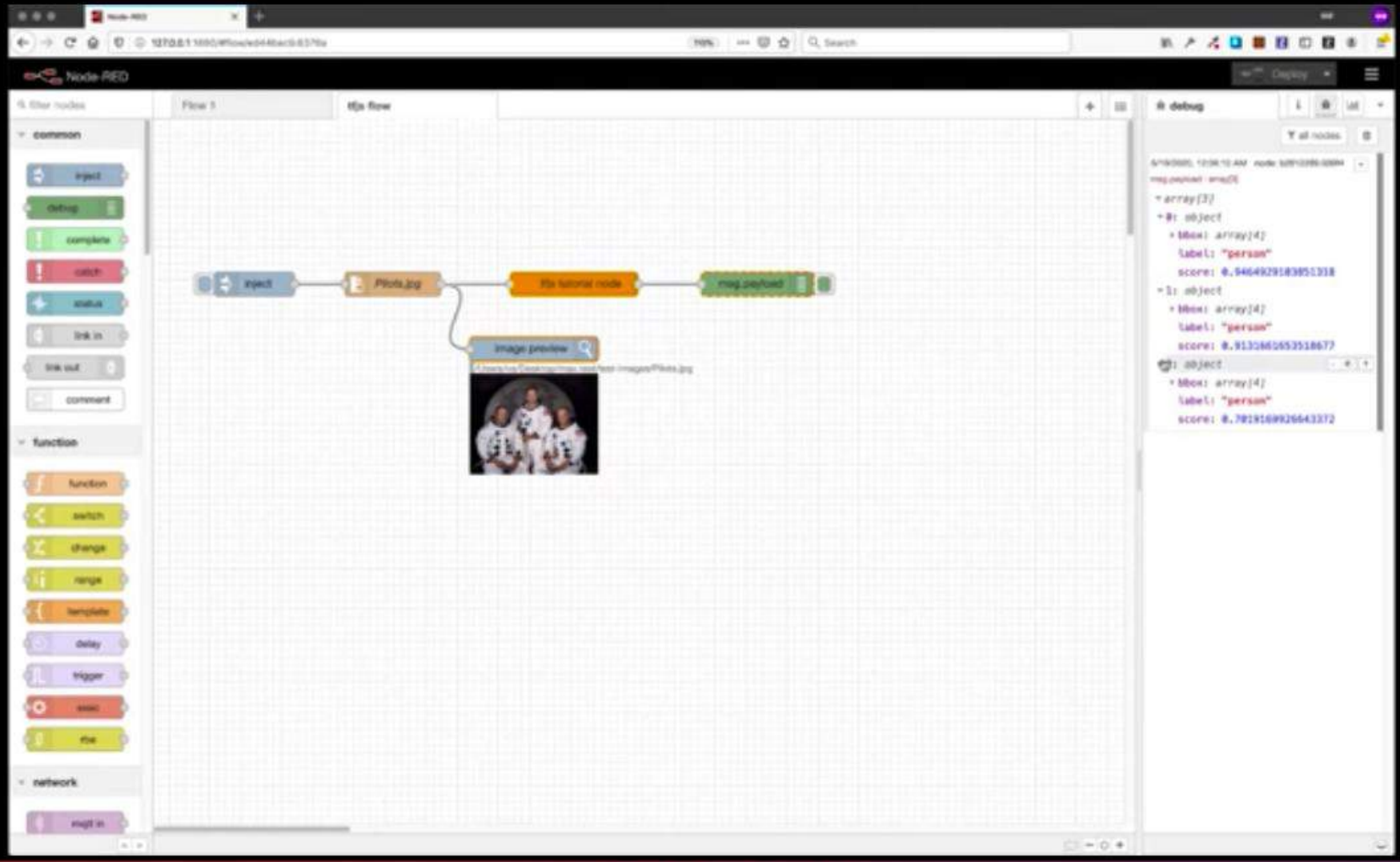

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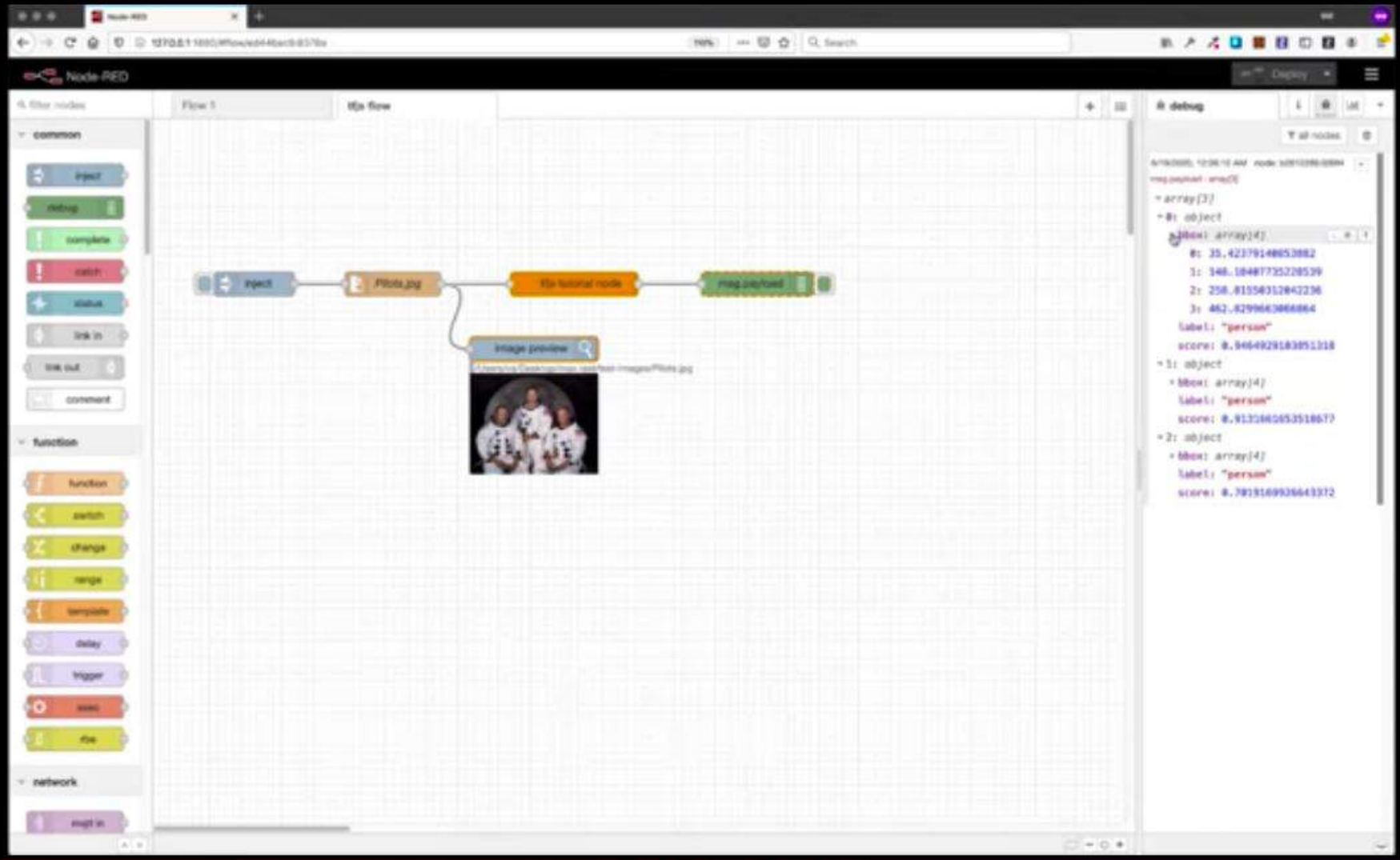

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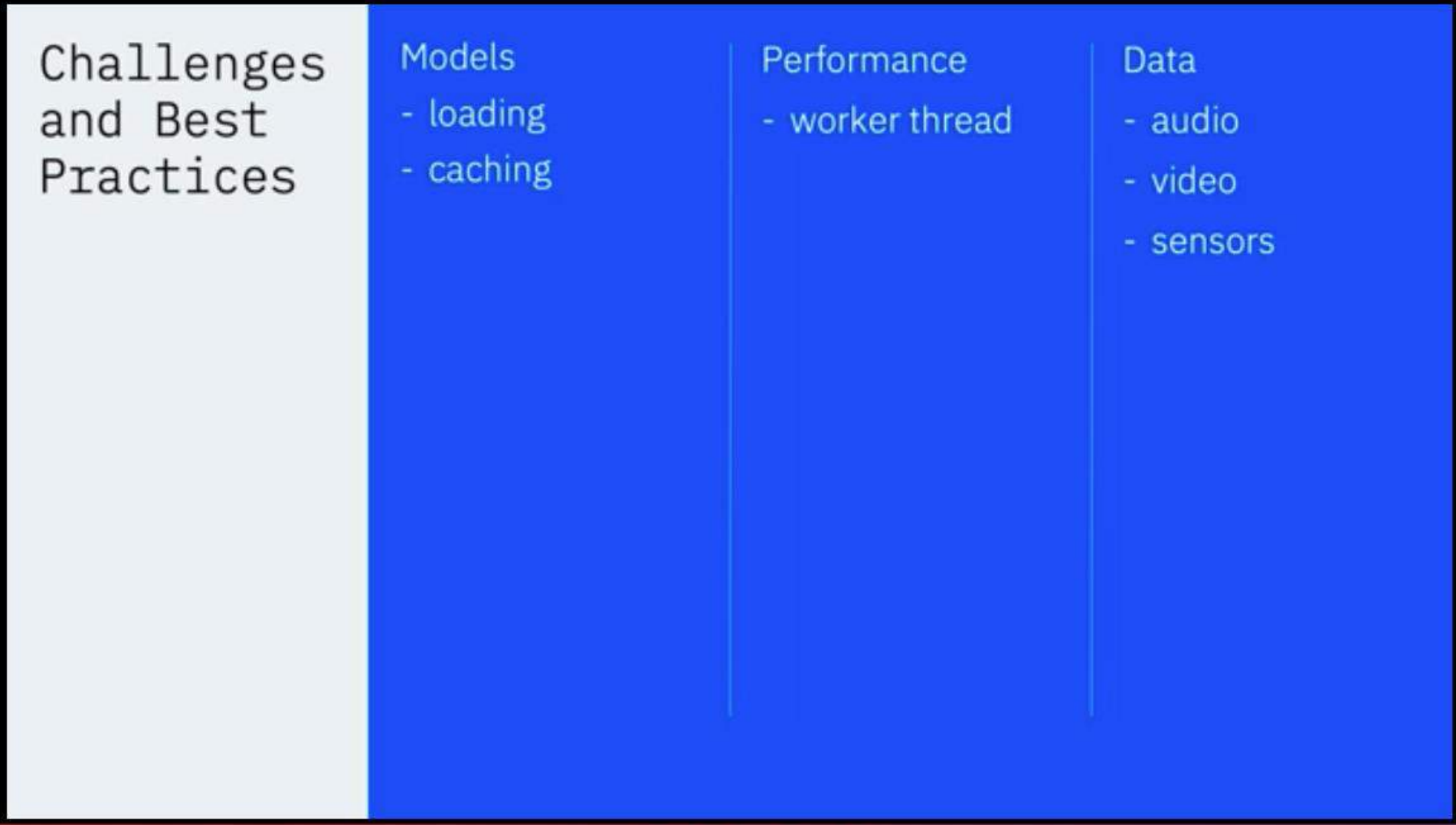

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Example Flows & Use Case

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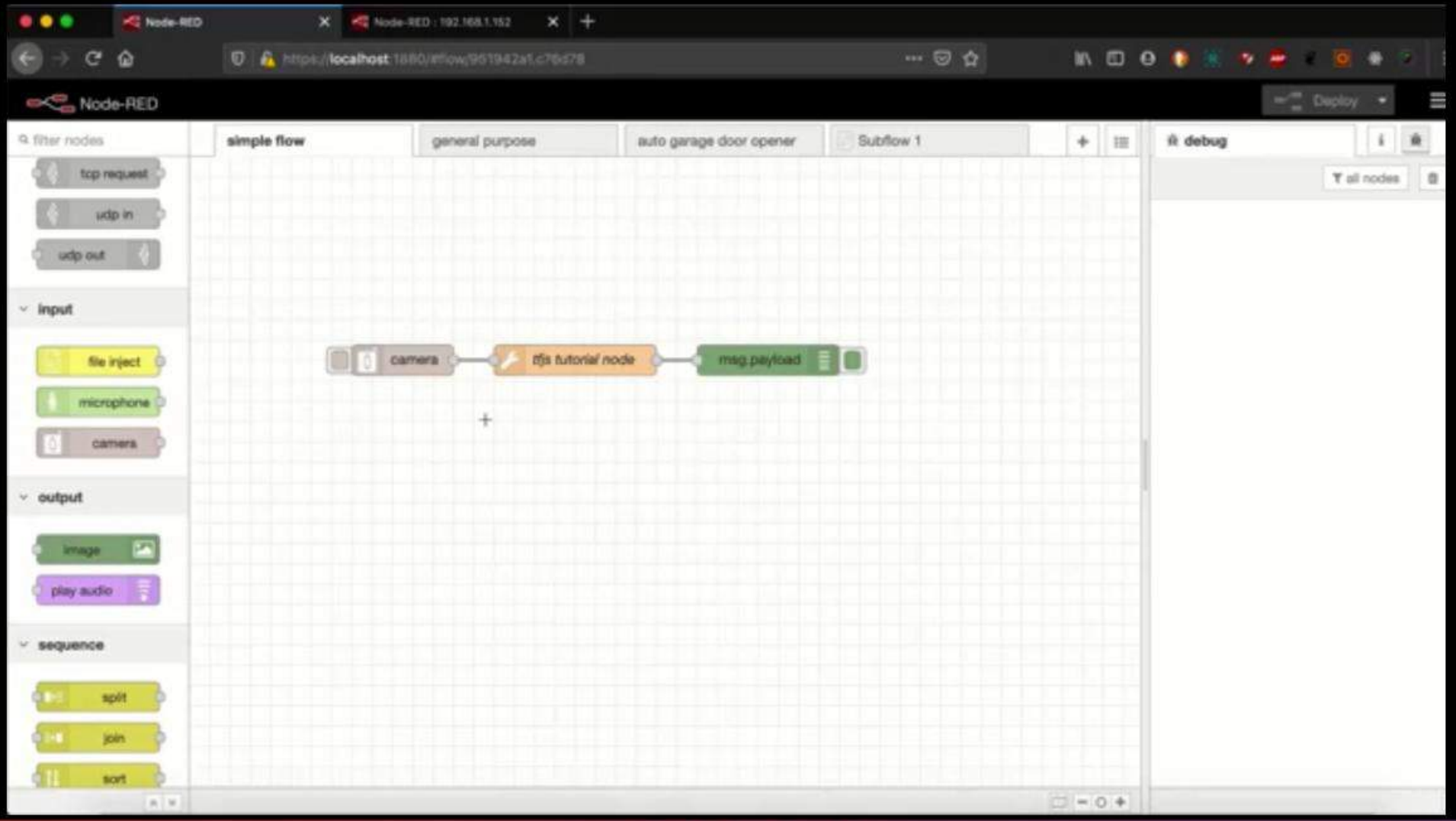

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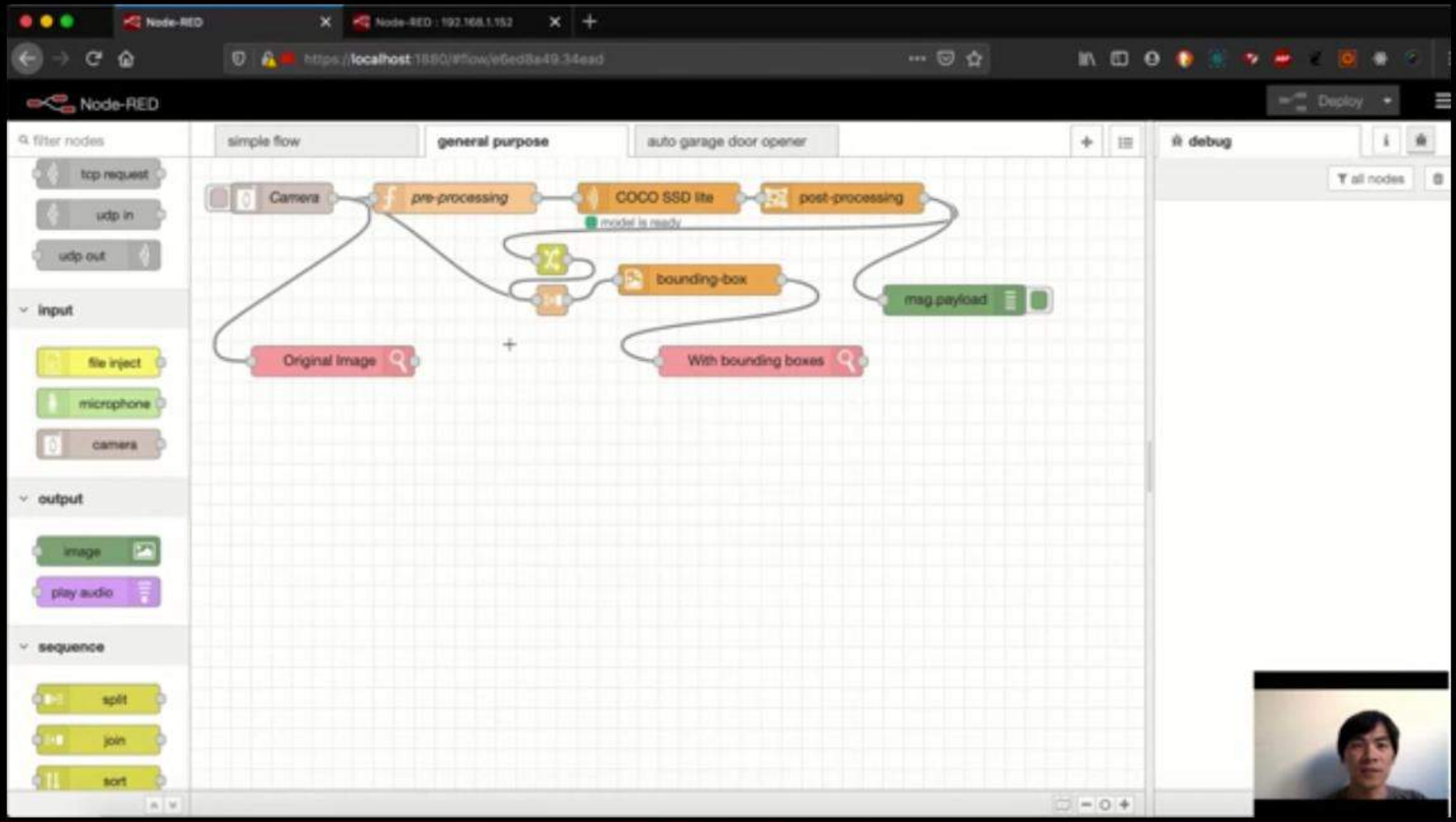

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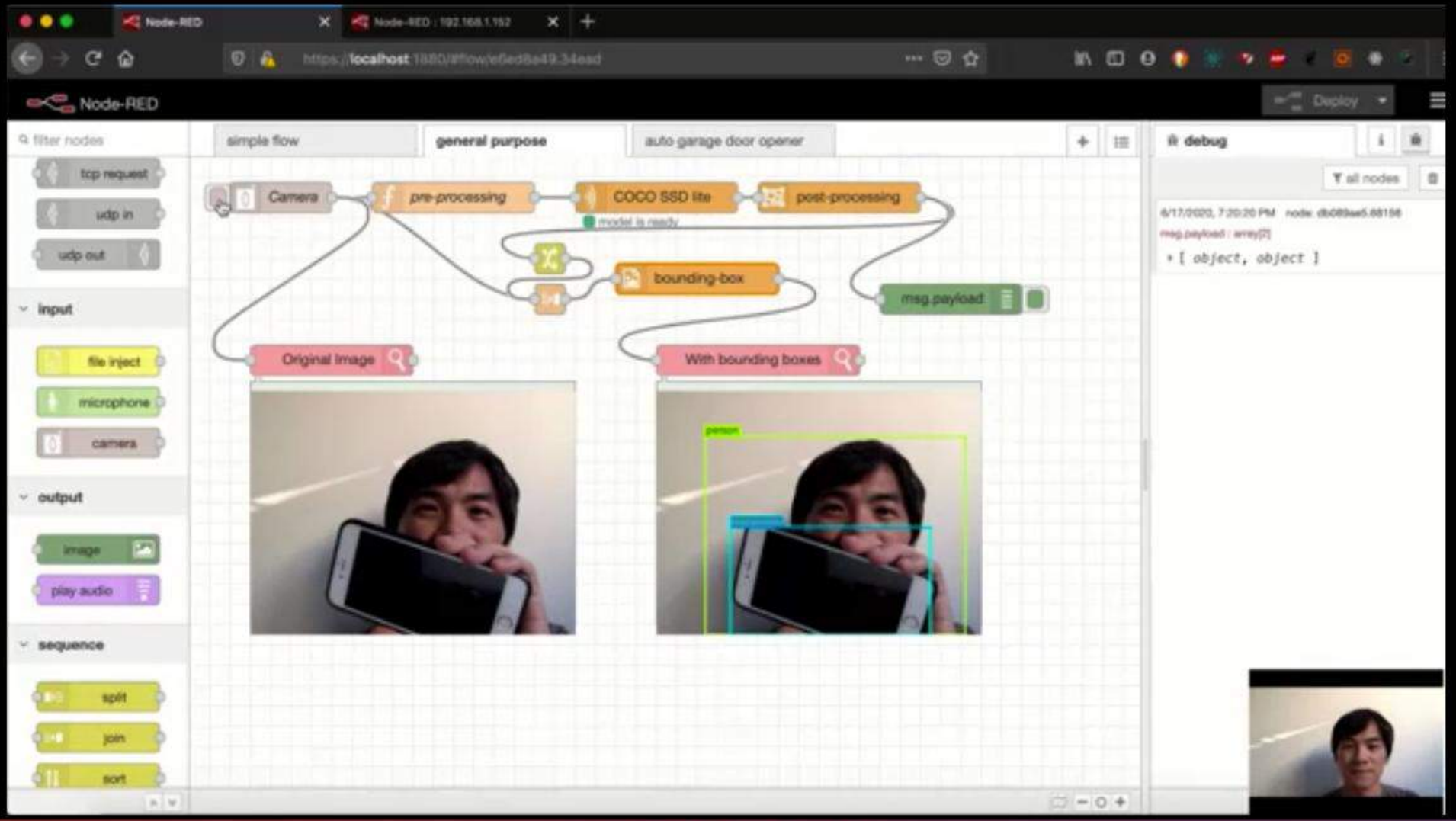

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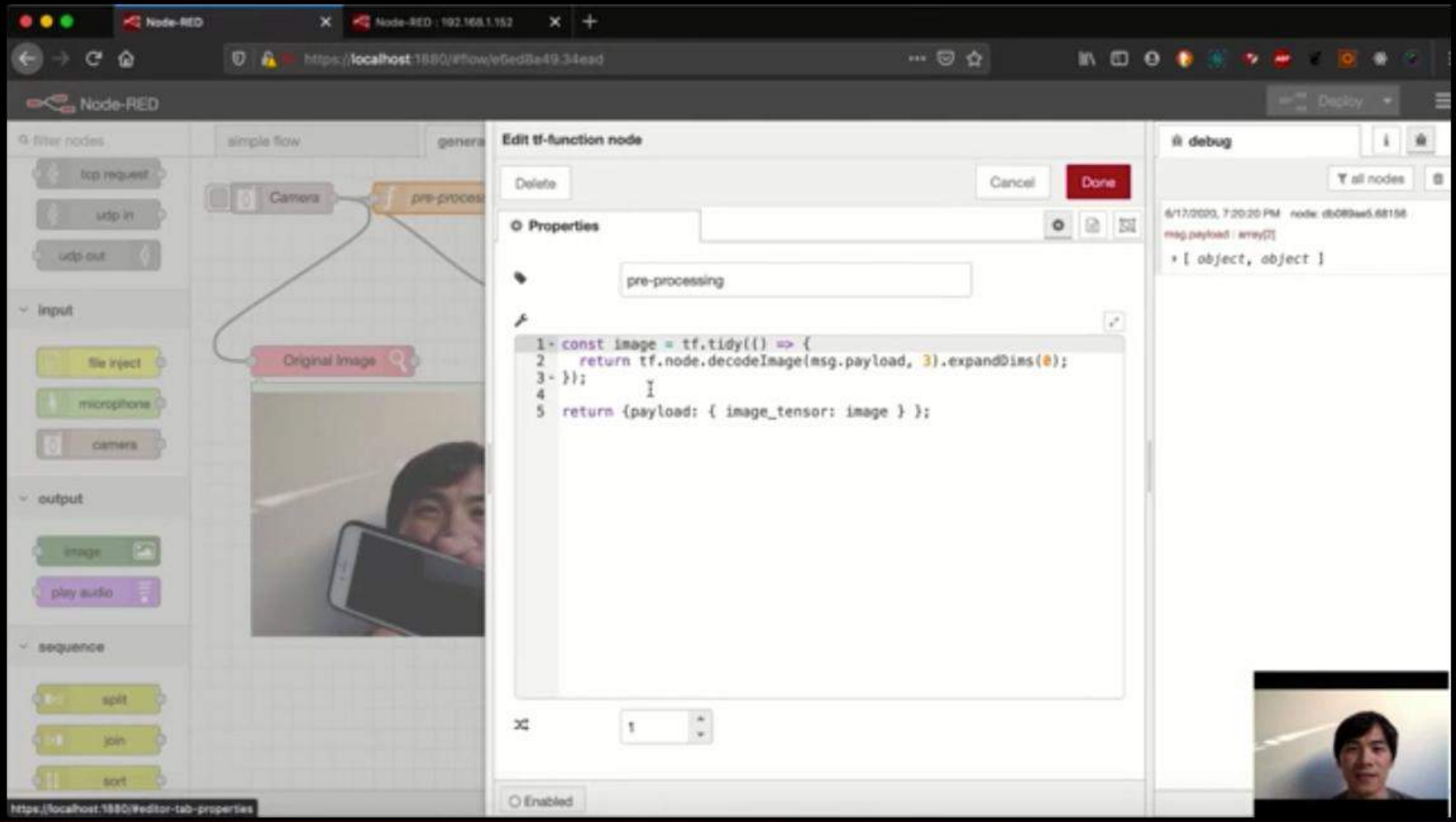

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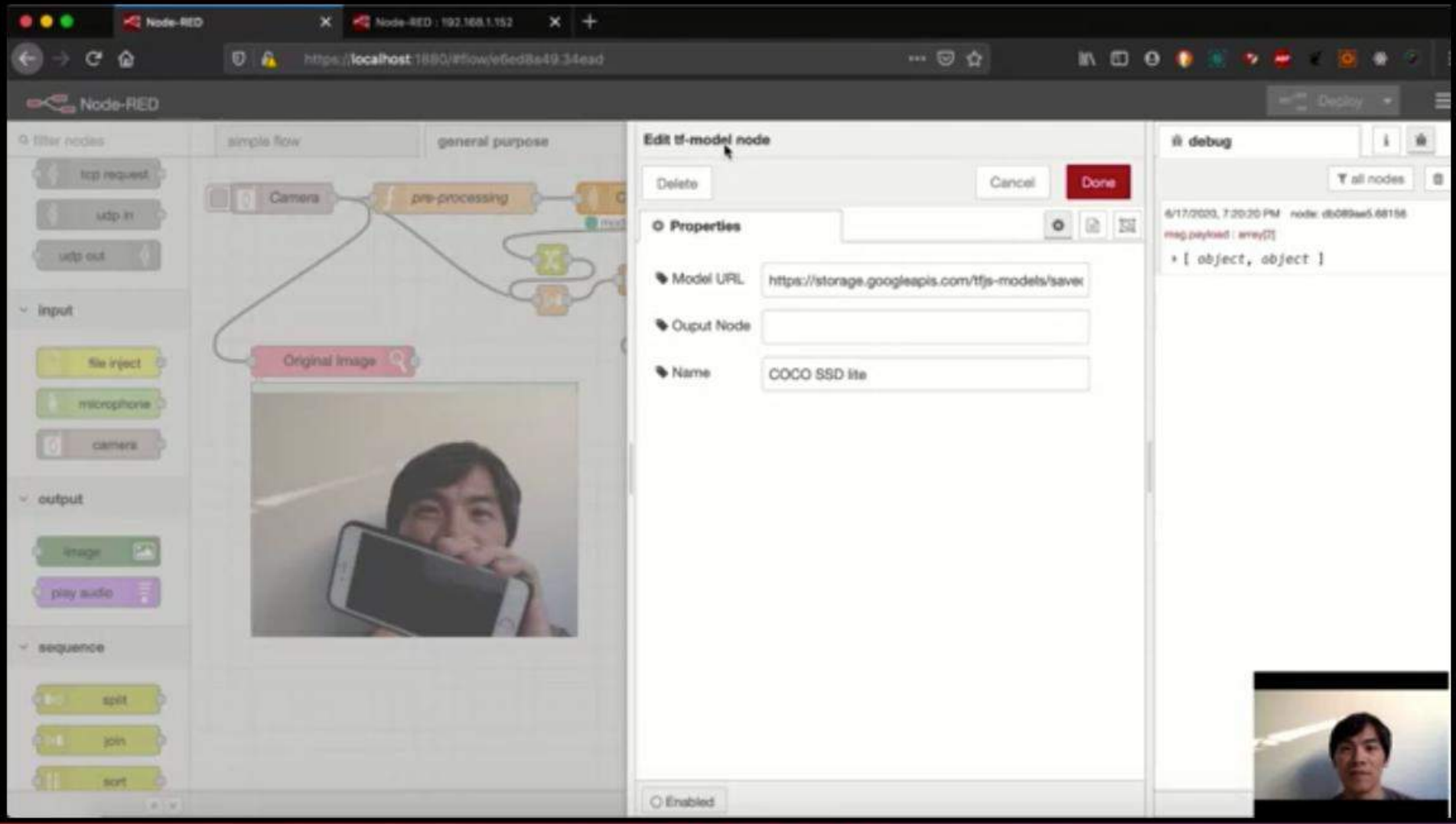

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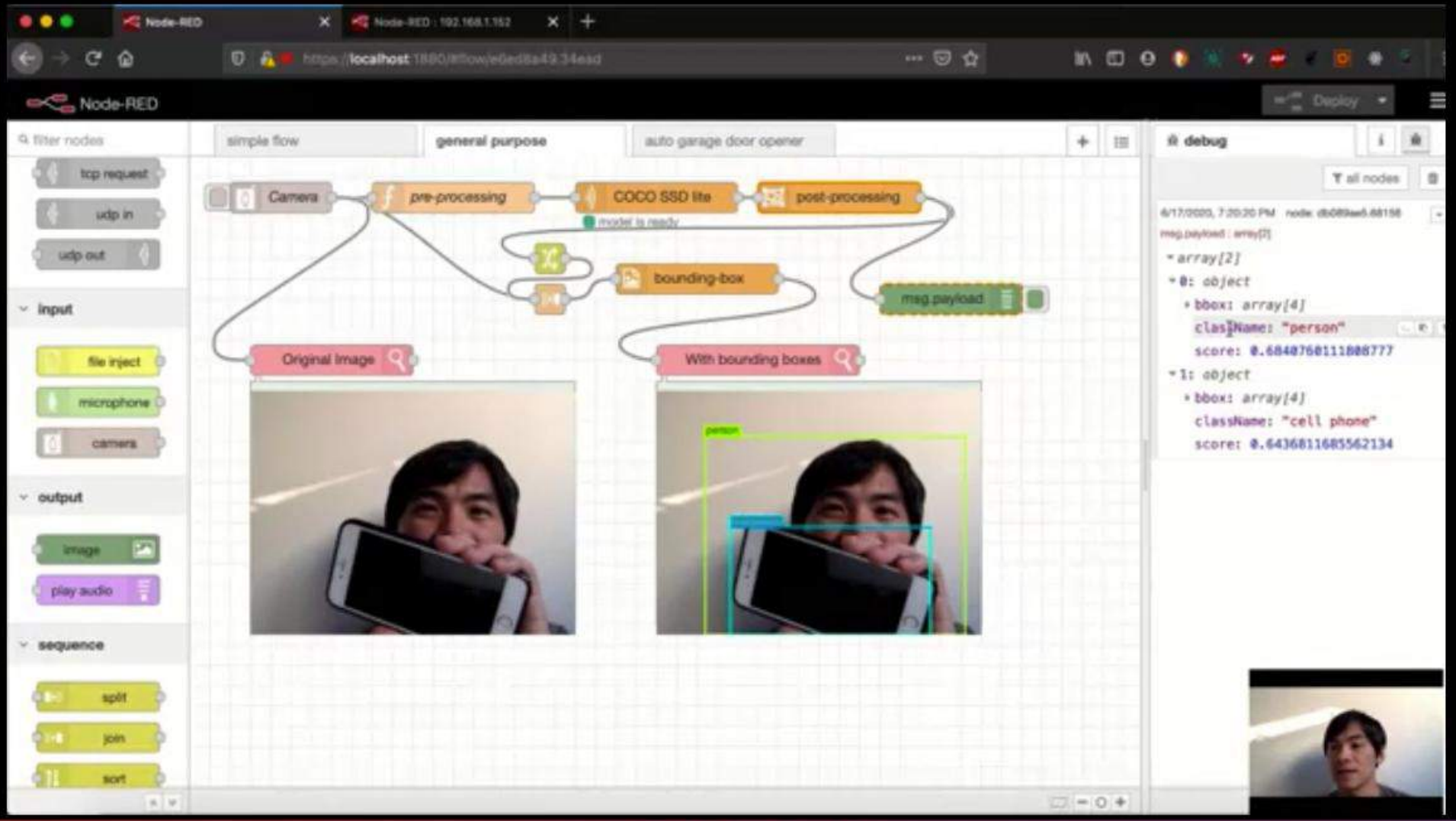

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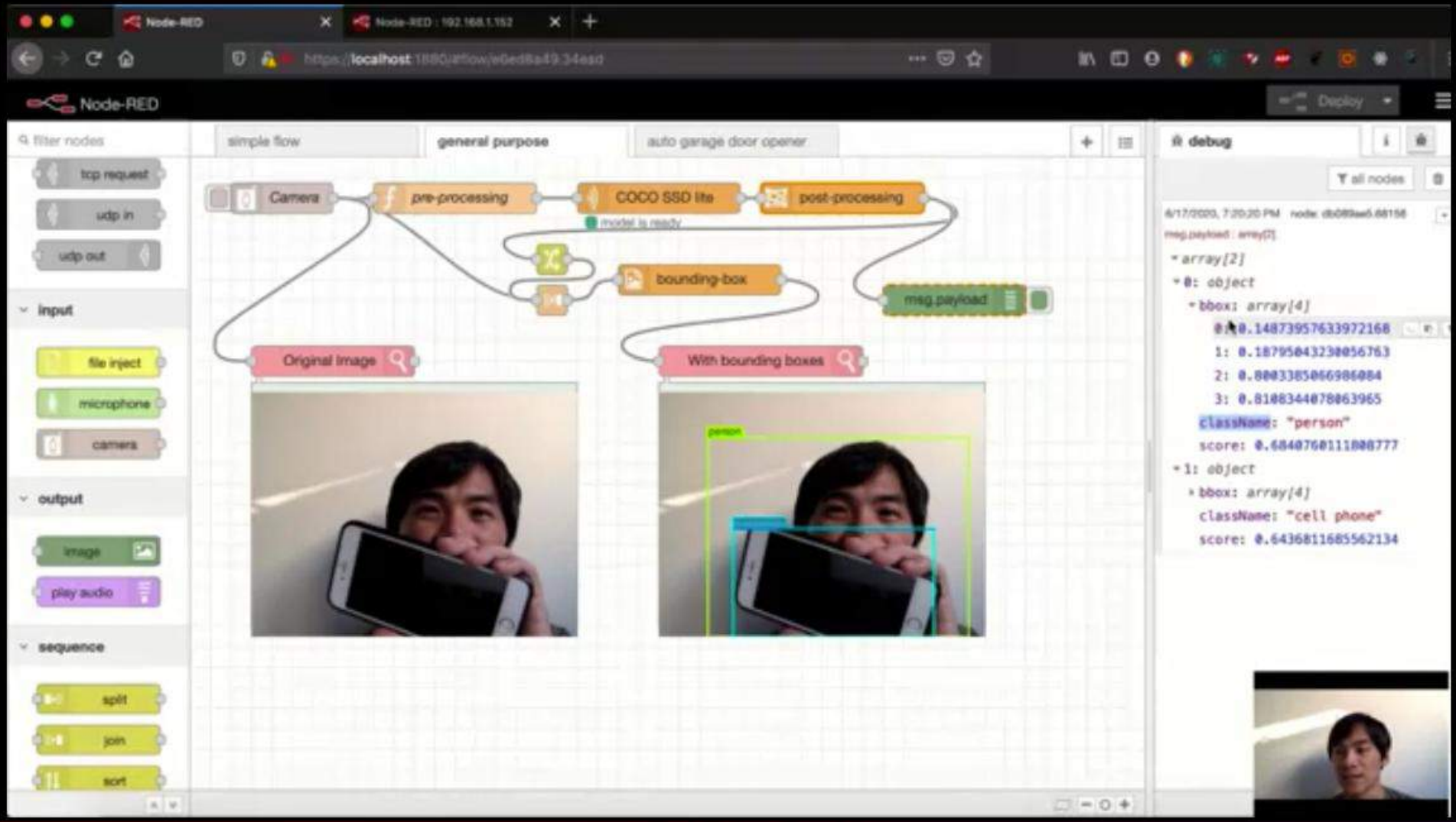

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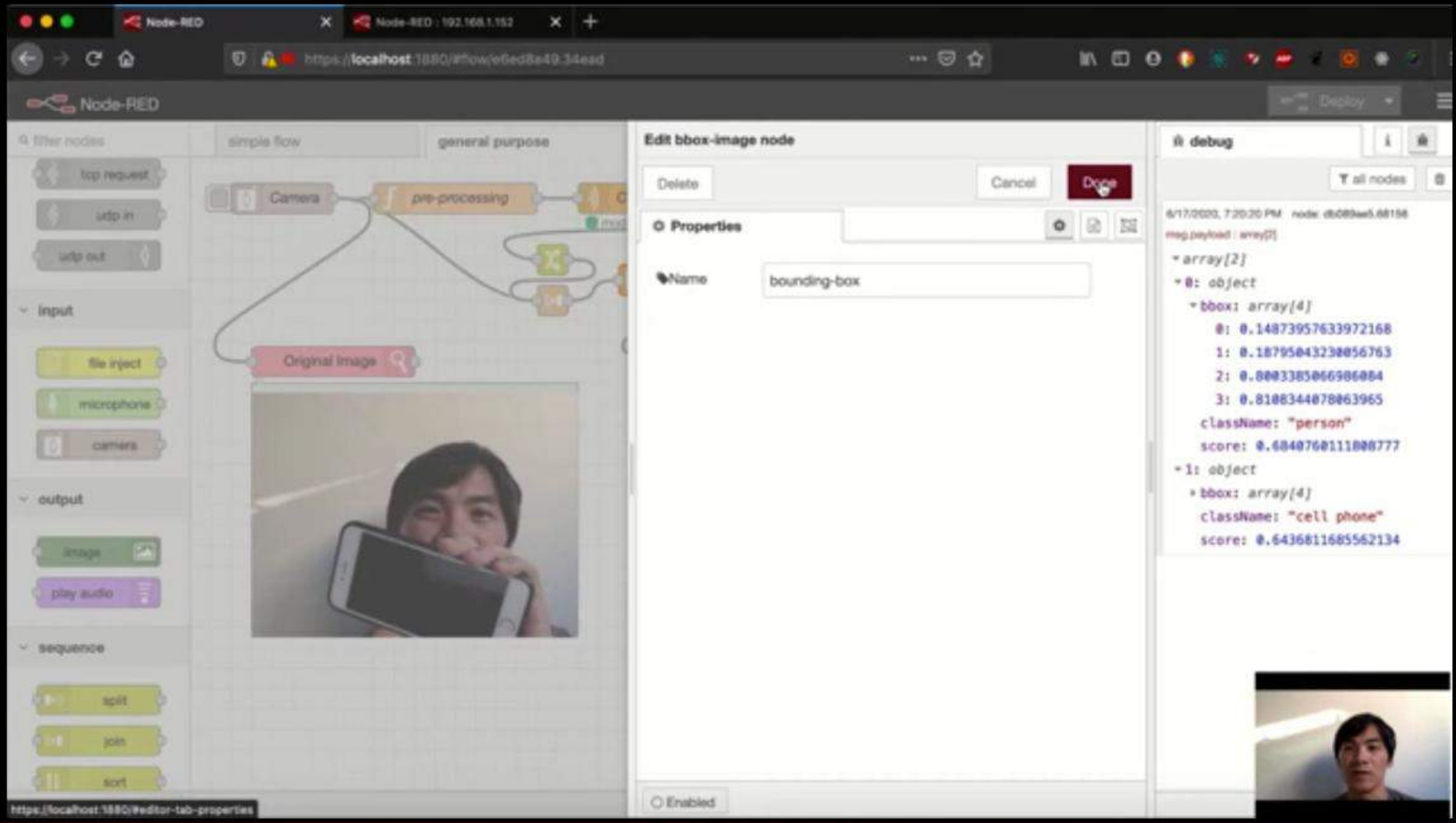

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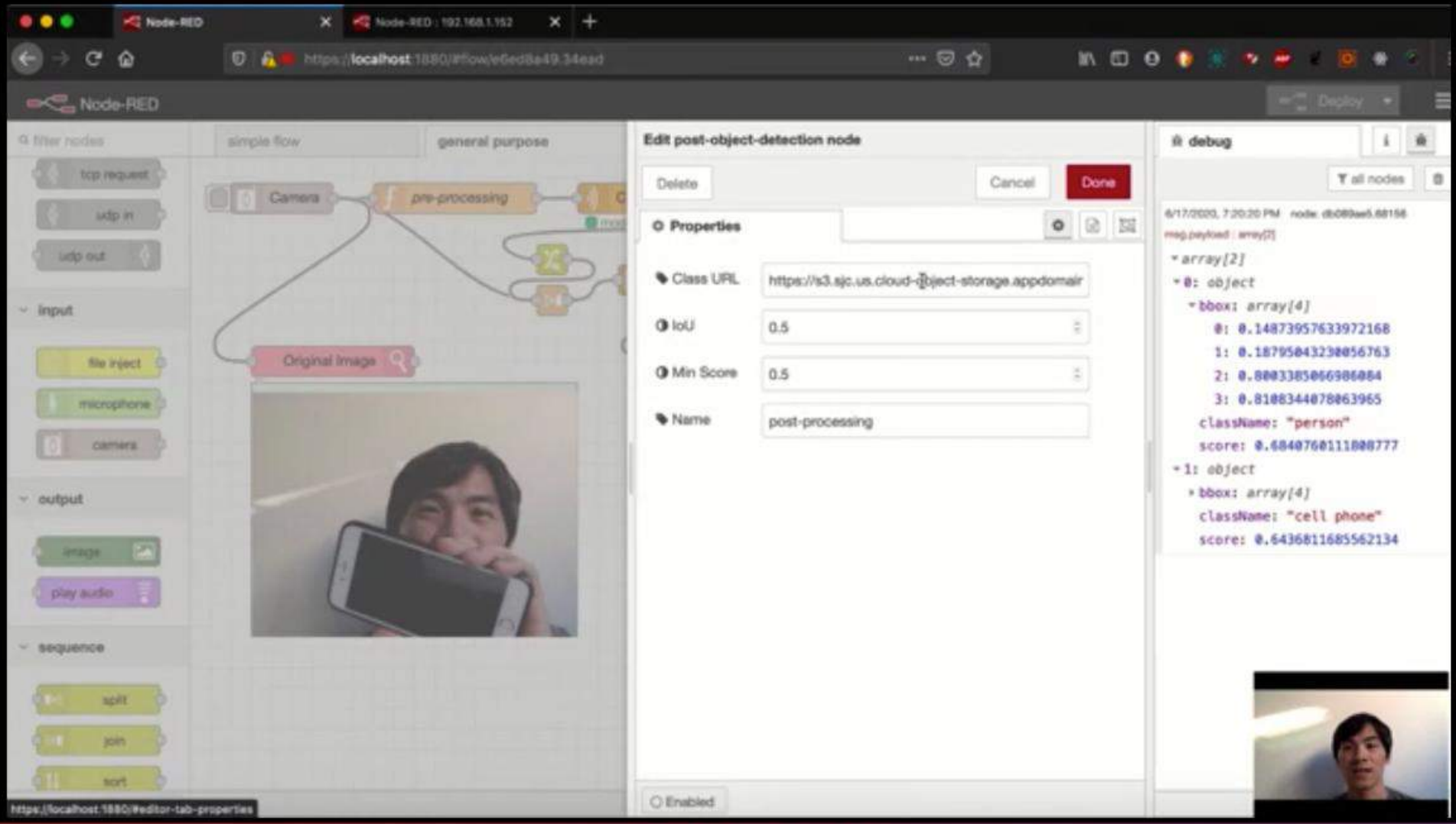


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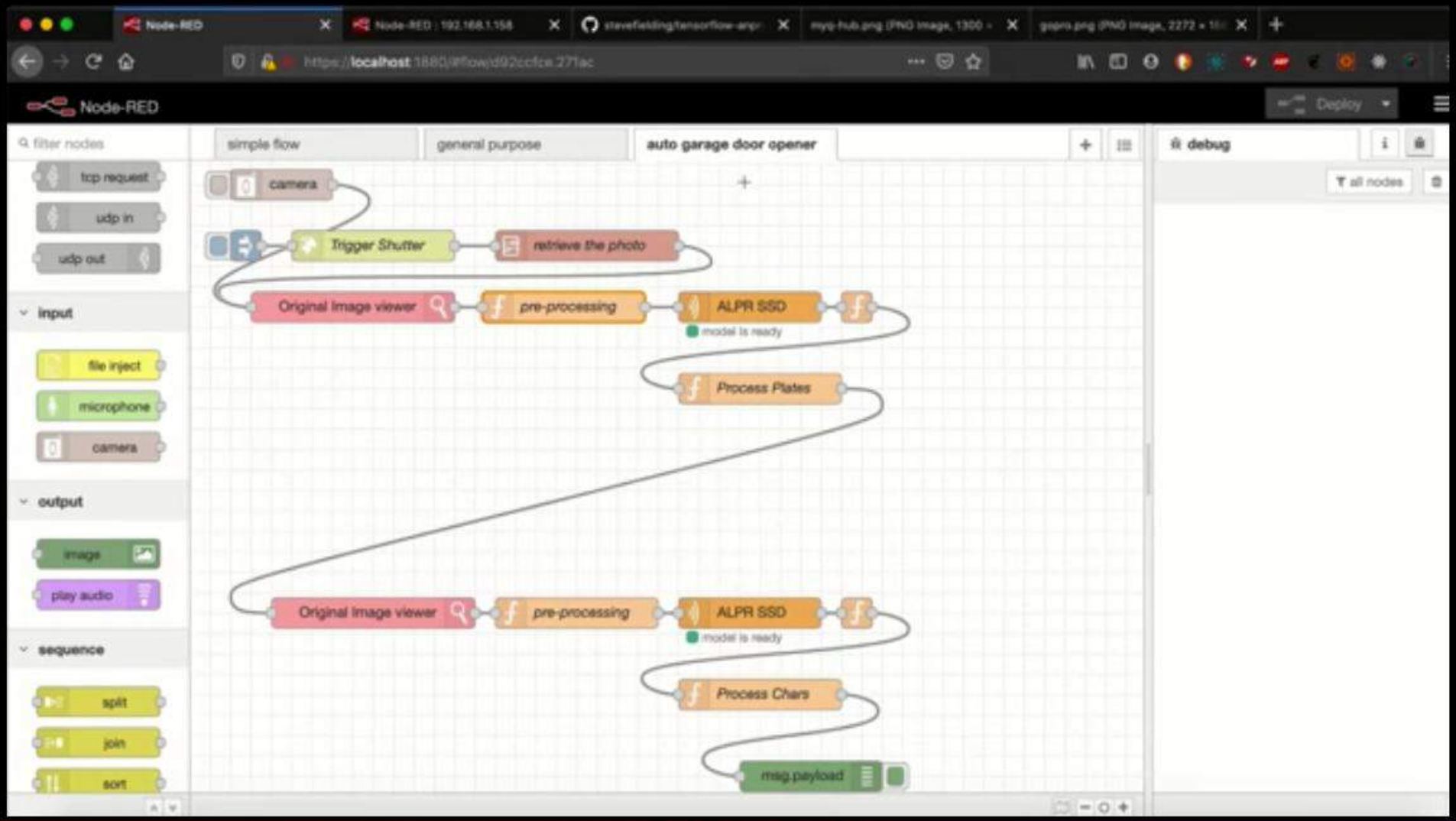

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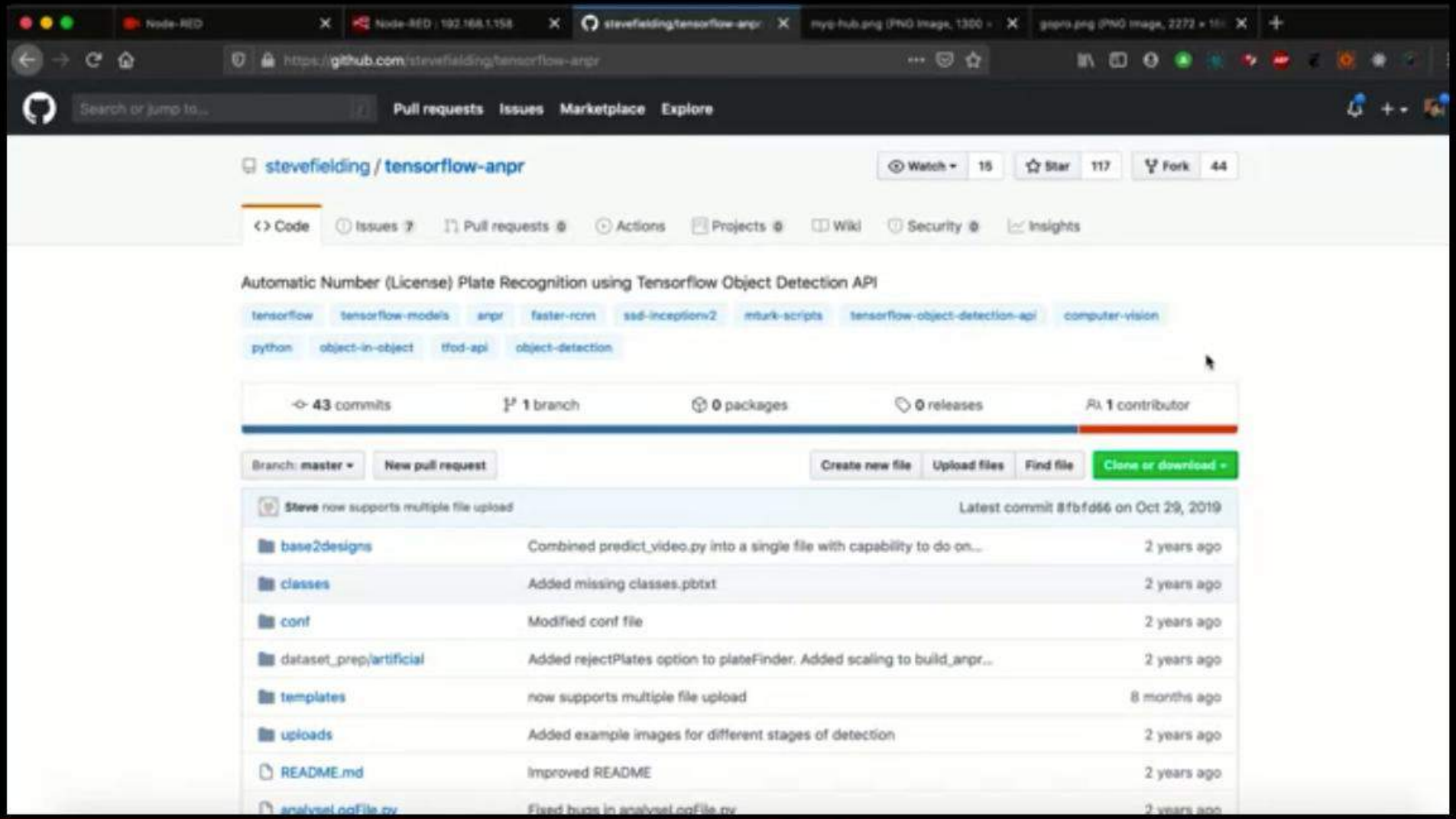

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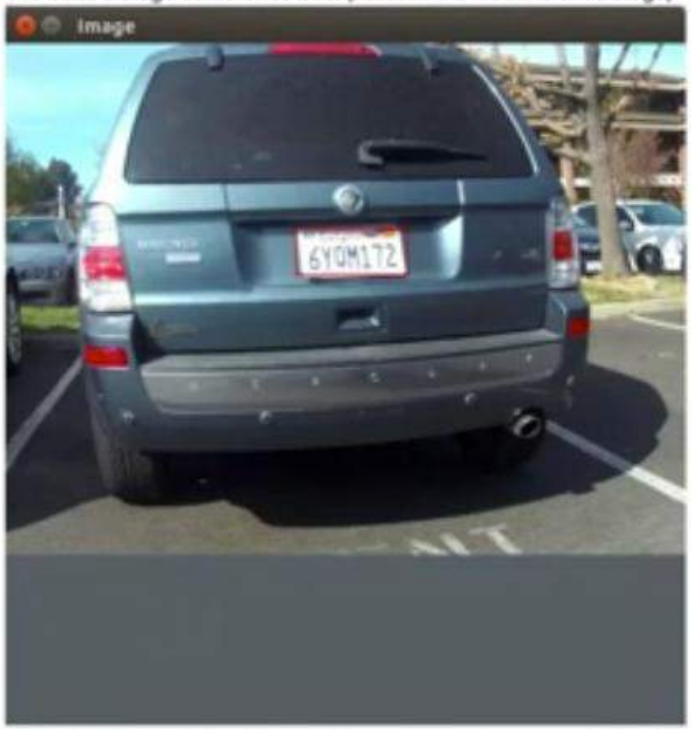
README.md

Automatic Number (License) Plate Recognition

Detect vehicle license plates in videos and images using the tensorflow/object_detection API.
Train object detection models for license plate detection using TFOD API, with either a single detection stage or a double detection stage.

VIDEO

Detect vehicle license plates in videos and images using the tensorflow/object_detection API.
Train object detection models for license plate detection using TFOD API, with either a single detection stage or a double detection stage.
The single stage detector, detects plates and plate characters in a single inference stage.
The double stage detector detects plates in the first inference stage,



crops the detected plate from the image, passes the cropped plate image to the second inference stage, which detects plate

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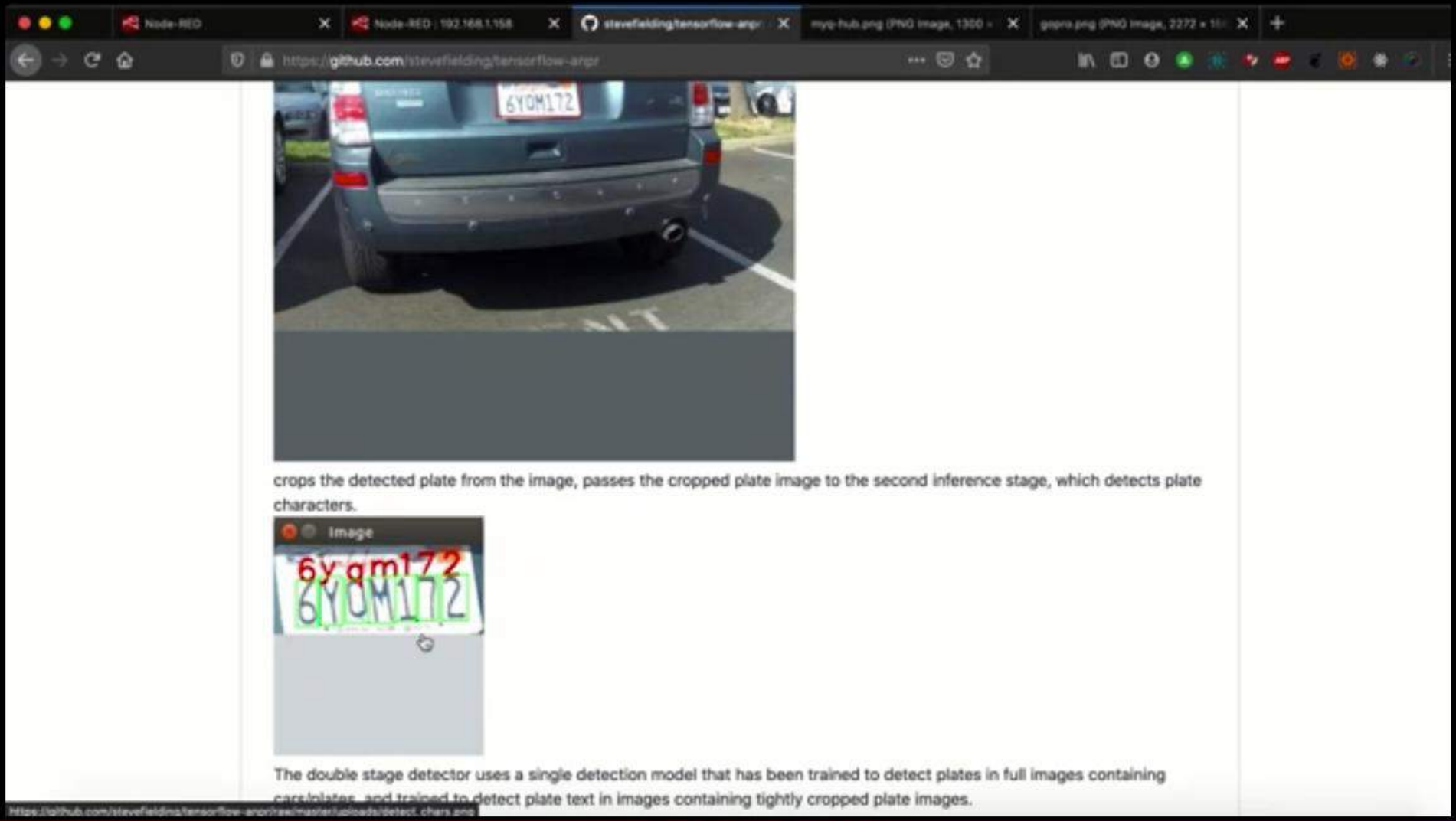

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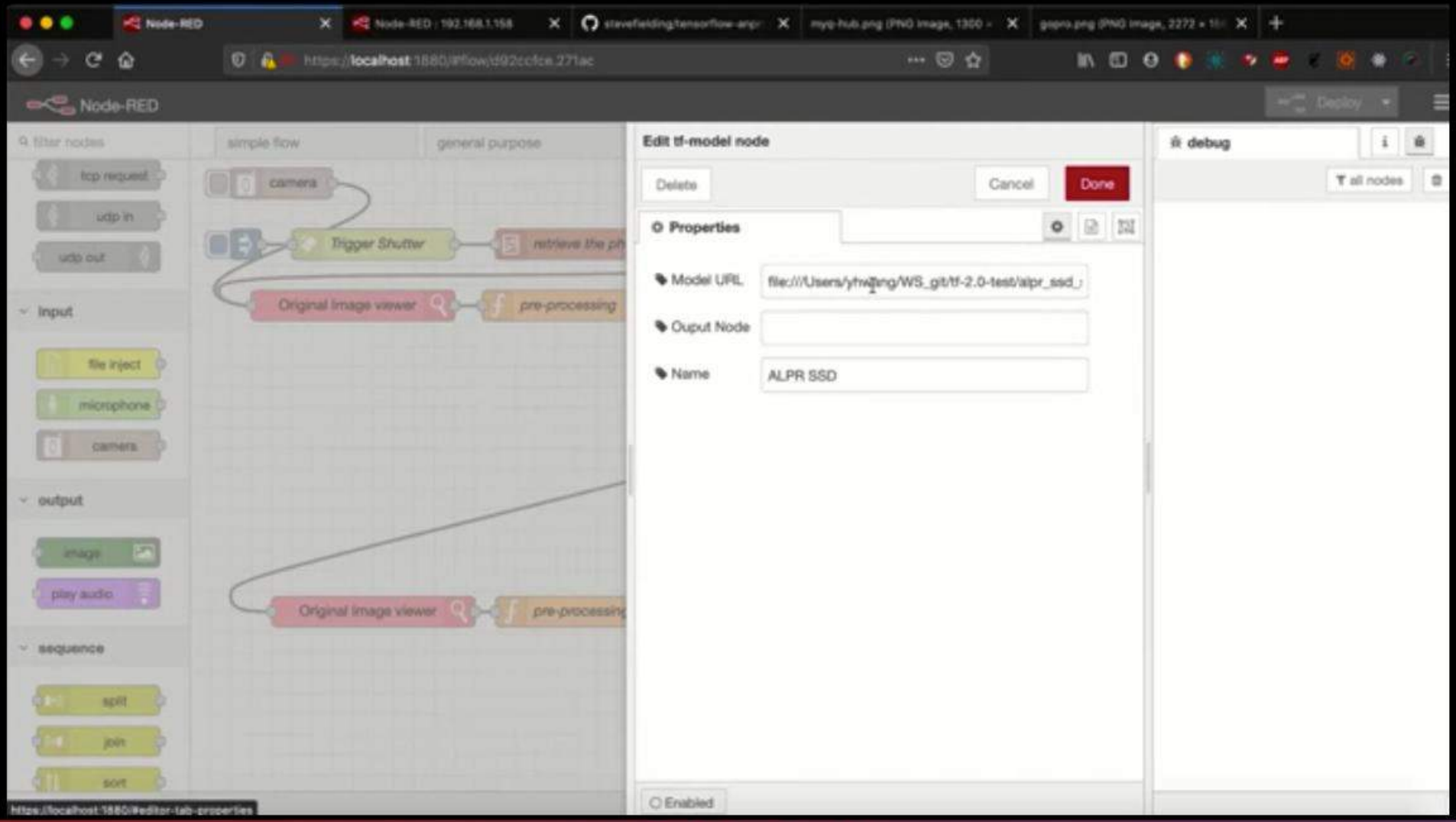

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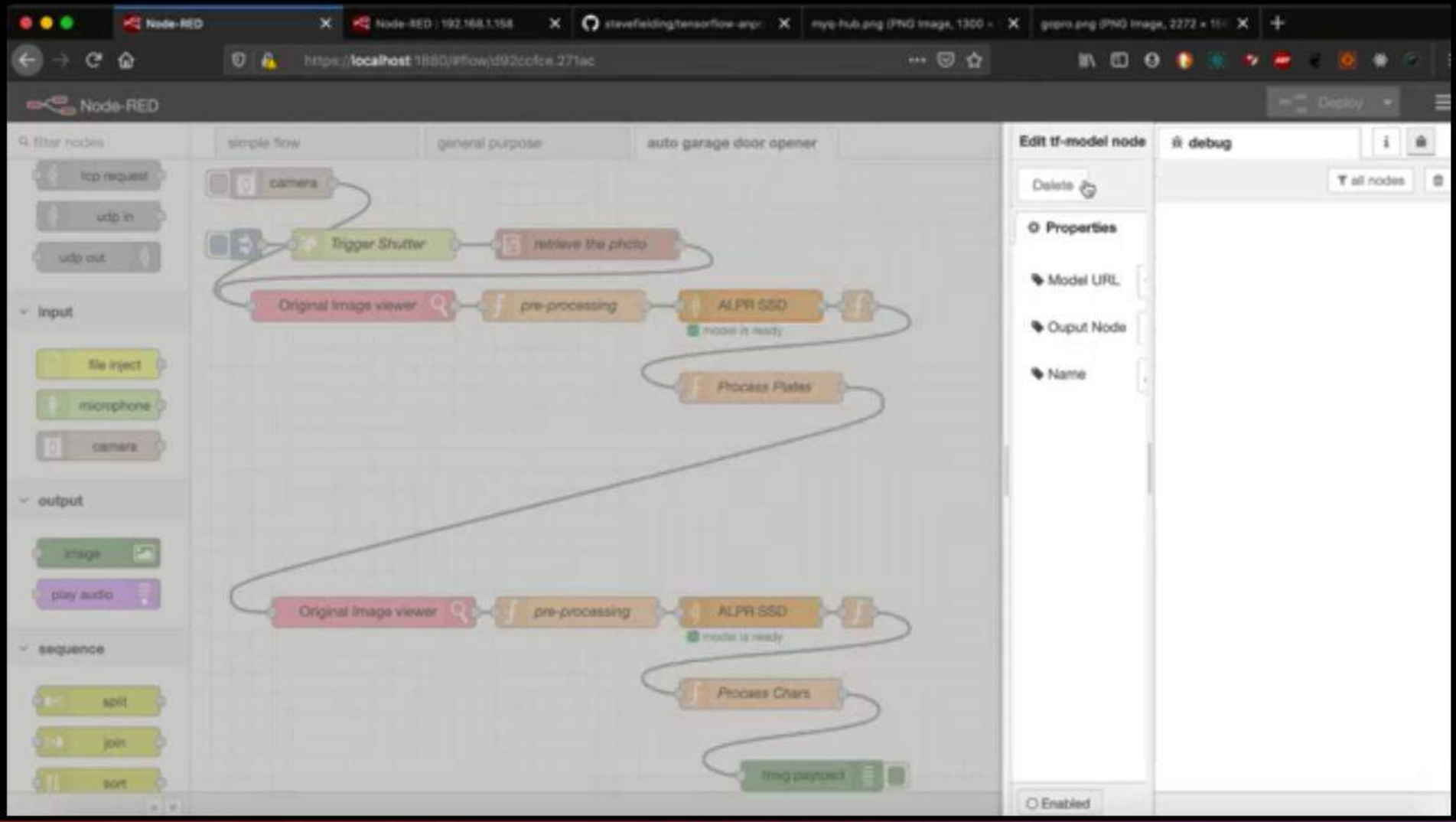

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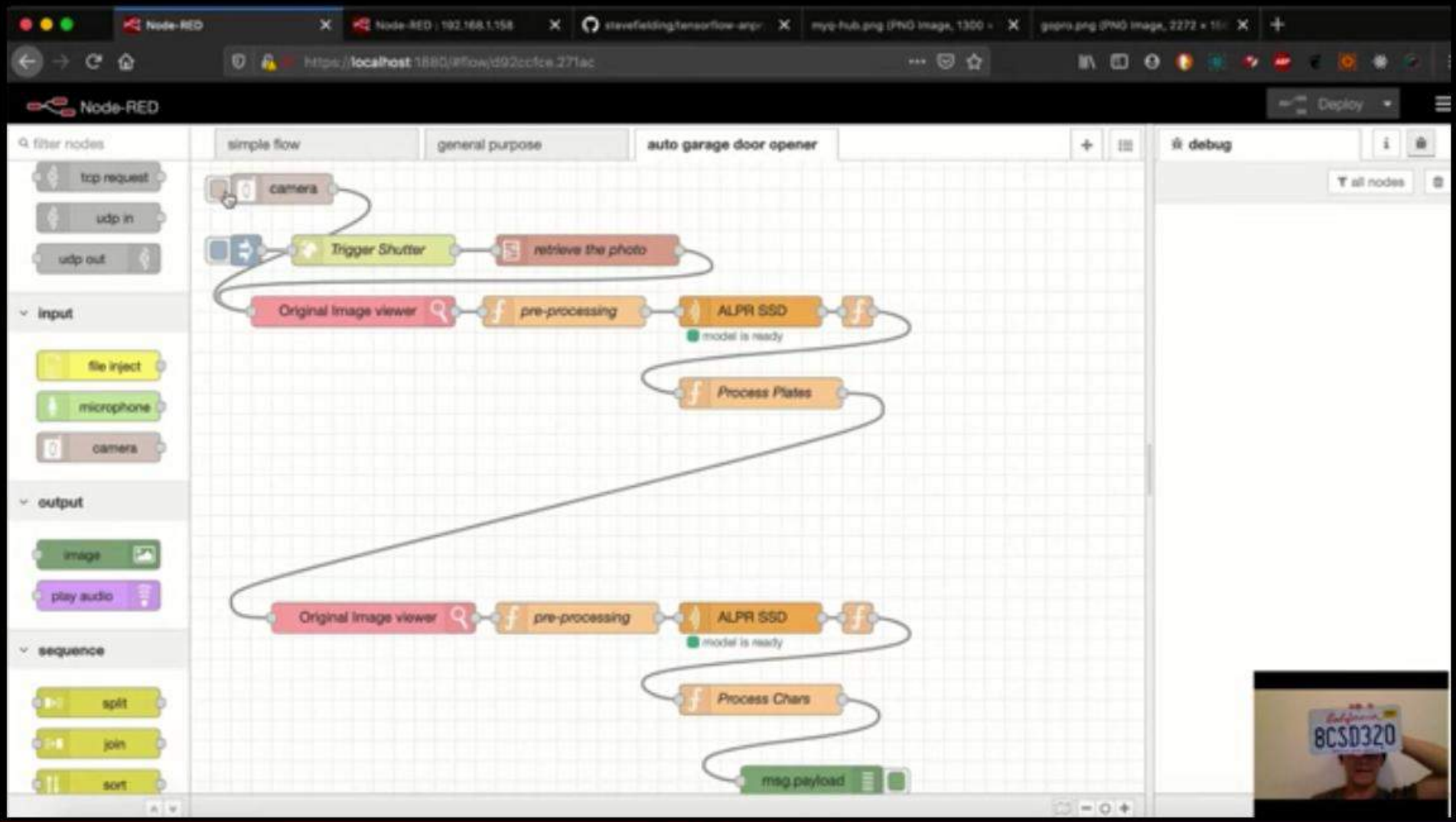

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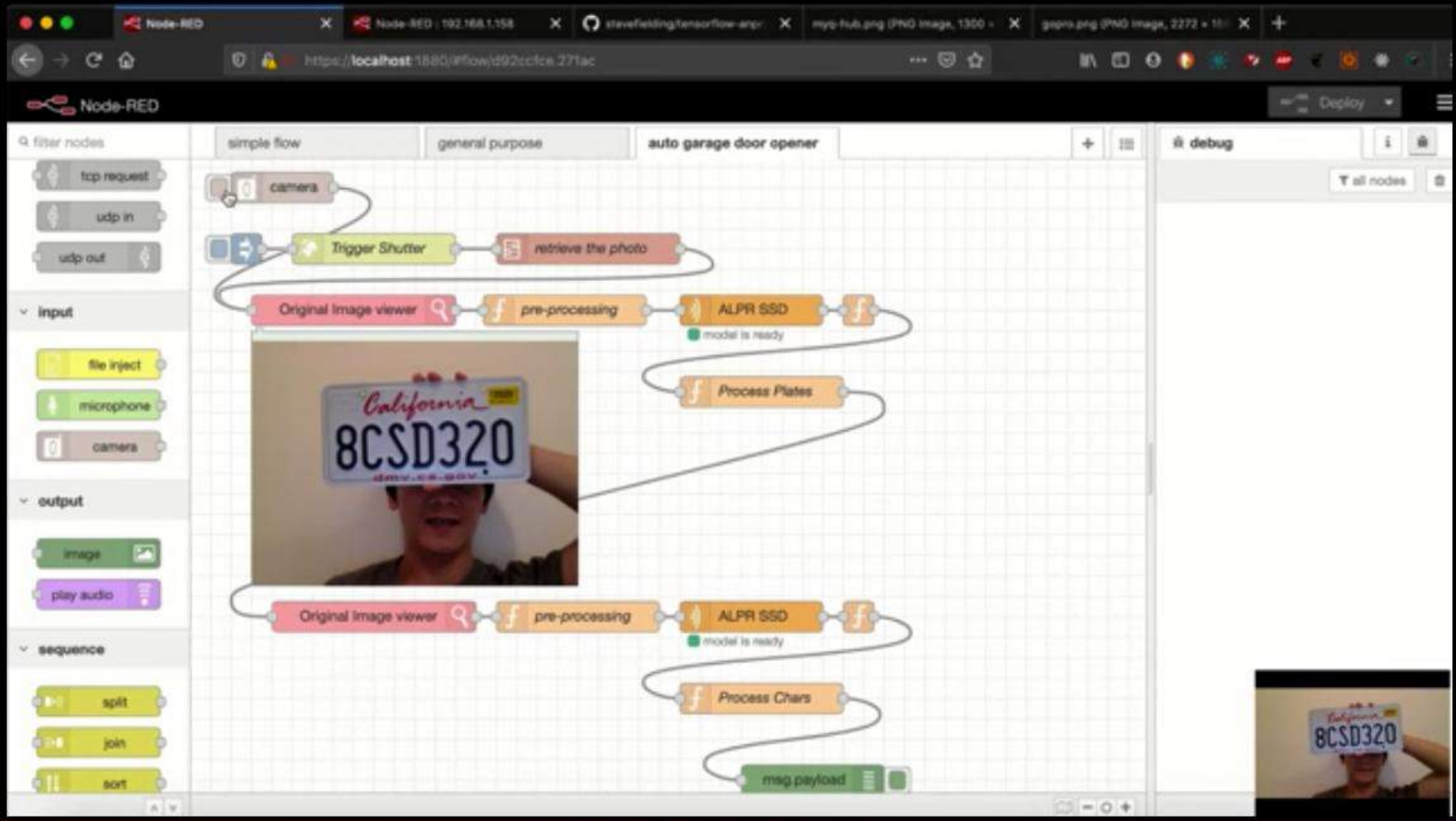

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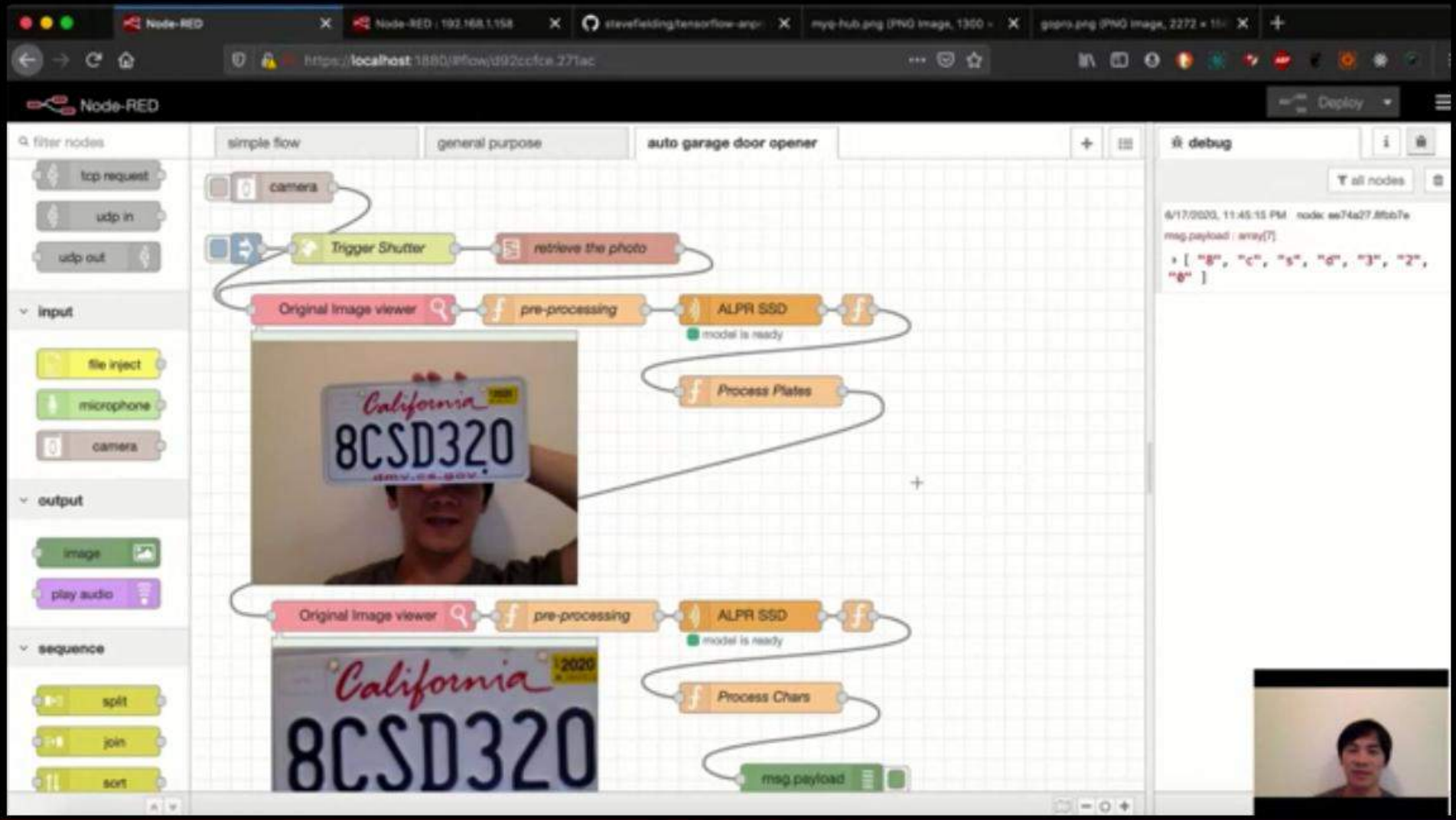

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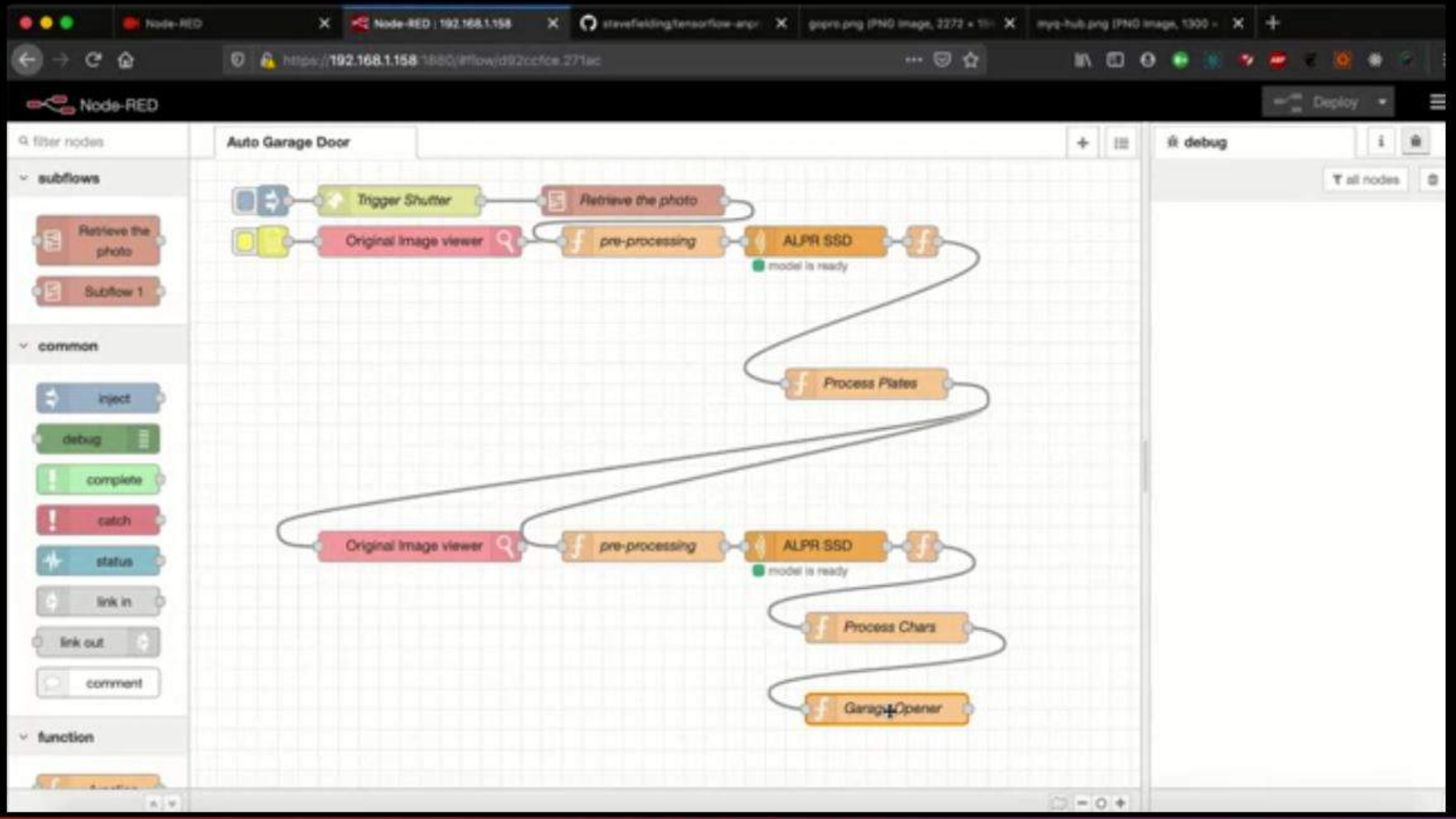

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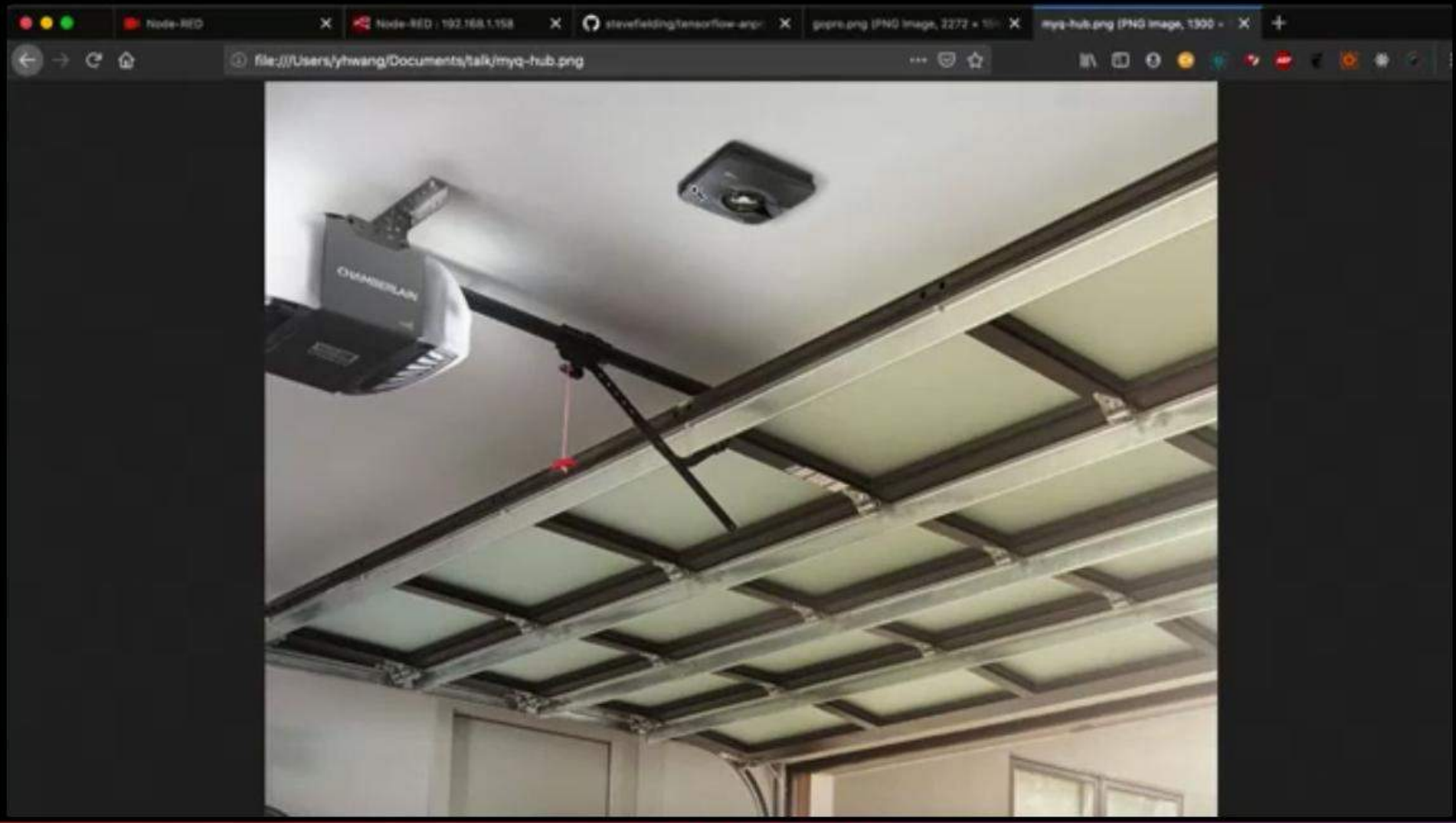

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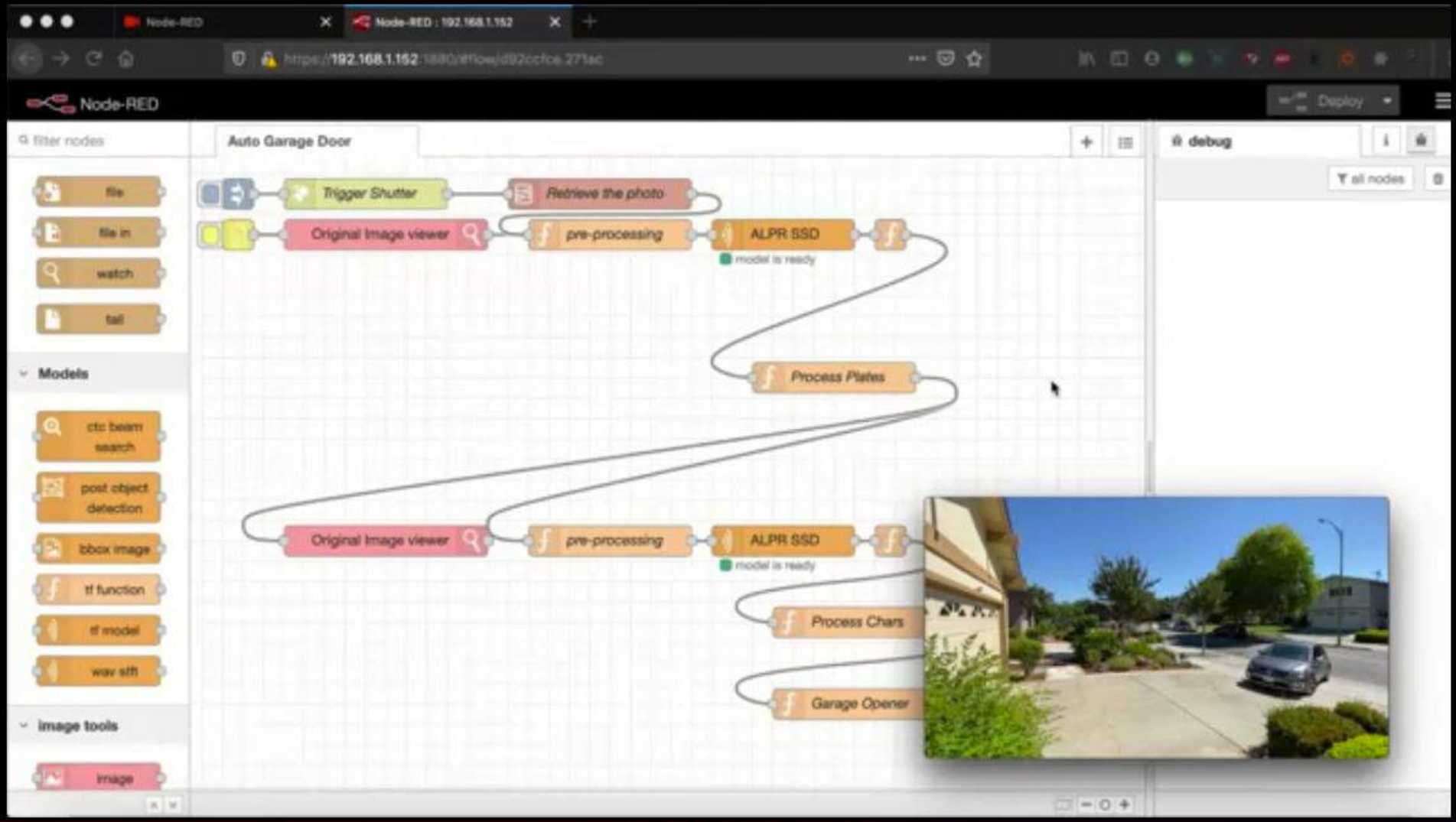

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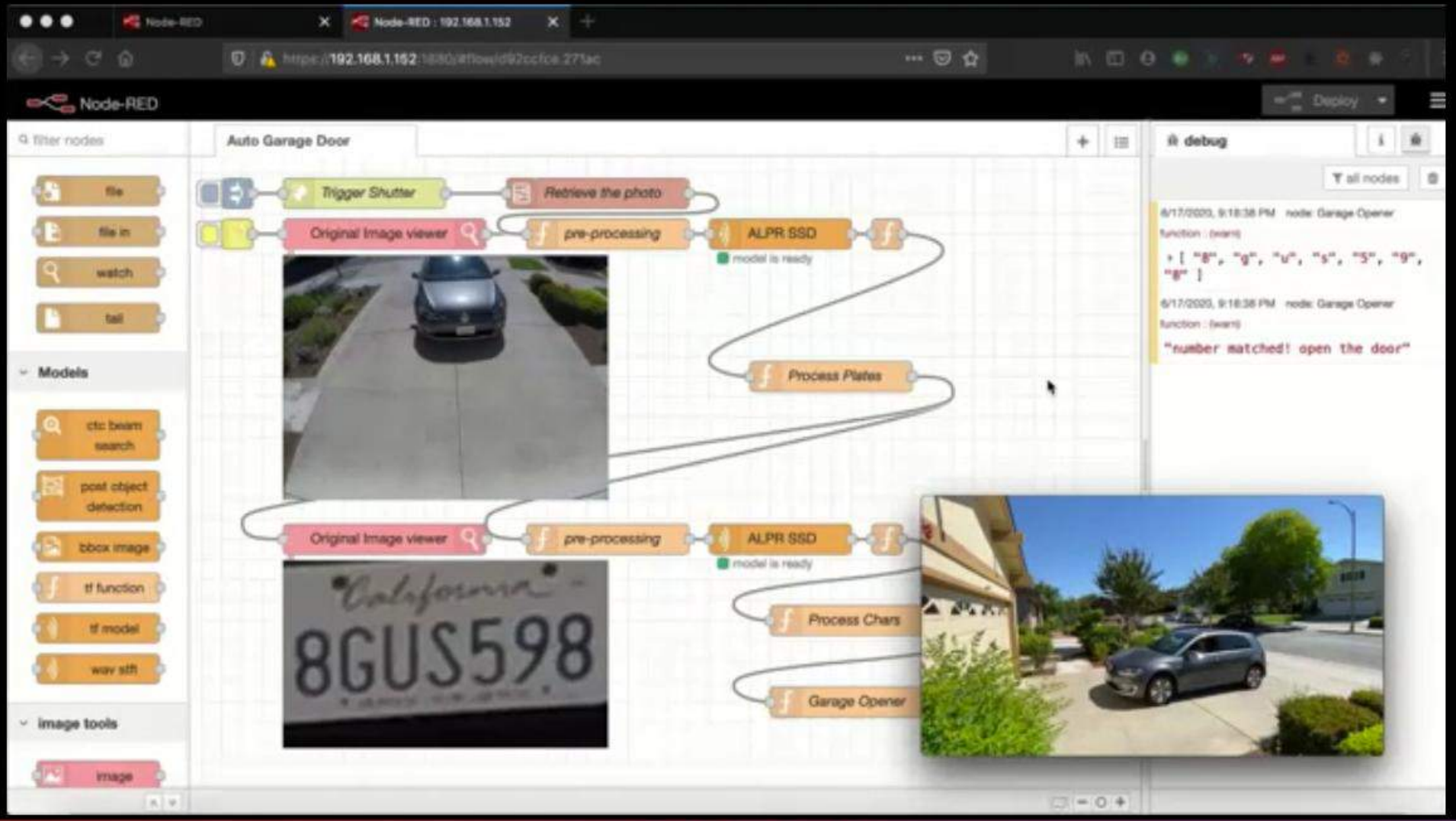

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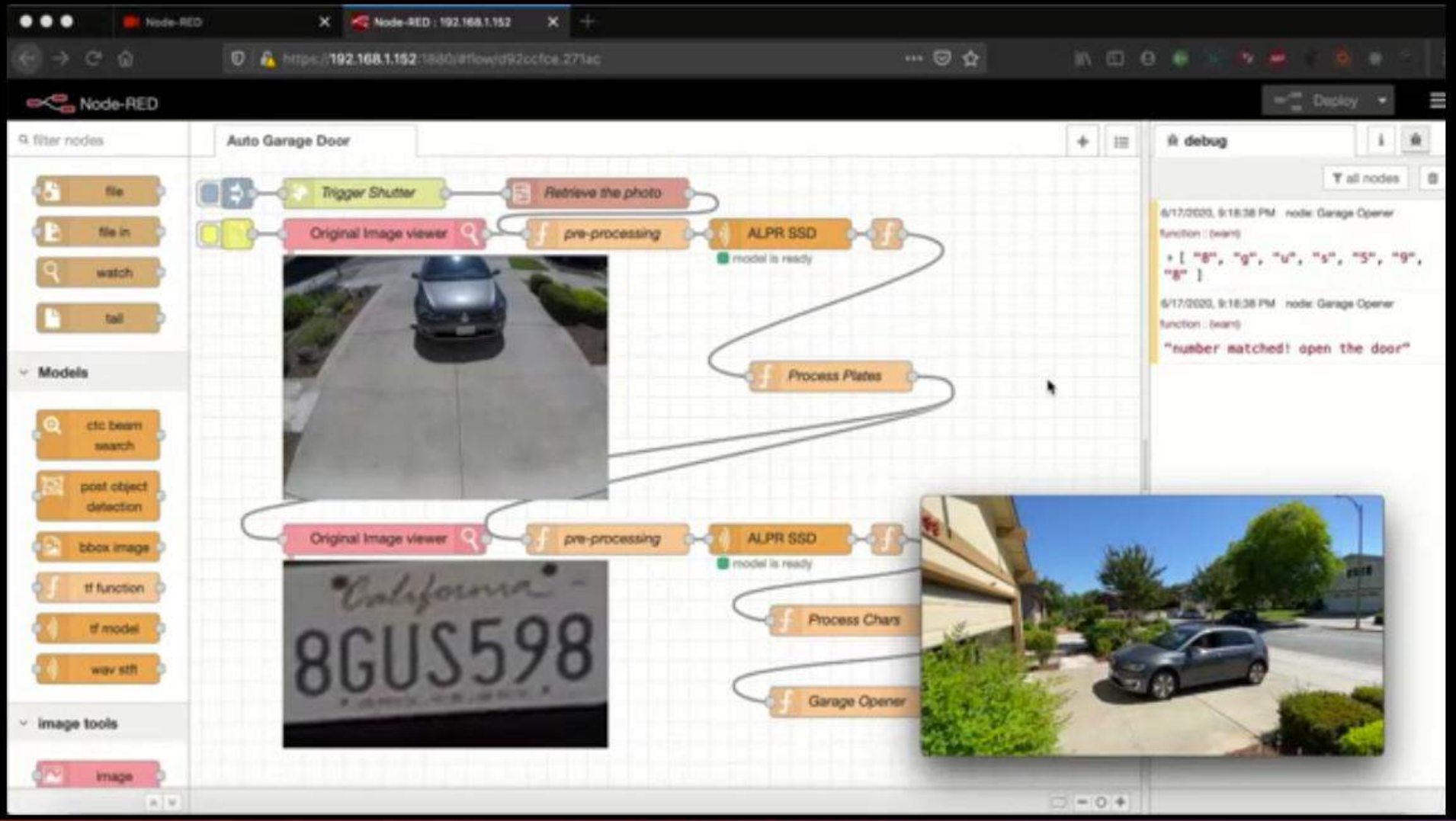

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Auto Garage Door

Auto License Plate Recognition

Recap

Node-RED

- Low-code platform for IoT
- Flexible and extensible
- Large NPM community

TensorFlow.js

- Machine Learning in JavaScript
- Data Privacy
- Network connectivity

Node-RED + TensorFlow.js

- Easy packaging of TF.js models for Node-RED usage
- Rapid building of AI-enabled IoT applications
- Leverage TensorFlow.js, Node-RED, Node.js, and NPM communities
- Democratize AI

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Links

https://js.tensorflow.org

https://nodered.org

https://github.com/yhwang/node-red-contrib-tf-model

https://github.com/vabarbosa/tfjs-node-red

https://github.com/IBM/node-red-tensorflowjs

https://medium.com/codait/a-low-code-approach-to-incorporating-machine-learning-into-your-iot-device-24f3f2a70717

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github.com/yhwang

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twitter.com/@vabarbosa
github.com/vabarbosa

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Q&A WITH SPEAKER | SPEAKER BIO

Yi-Hong Wang
Software Developer
IBM

YiHong is a software developer with the Cognitive OpenTech Group at the IBM Silicon Valley Lab. He has been an active contributor in the TensorFlow community for the past 2 years. He is also a committer in the node.JS community.

Va Barbosa
Software Developer
IBM

Va is a software developer with the Developer Advocacy Group at IBM. He has been an active contributor in the TensorFlow community for the past 2 years.

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