

IBM HACK CHALLENGE 2021

AI-Assisted Farming for Crop Recommendation & Farm Yield Prediction Application

TEAM MEMBERS :

1. SANJEET S

2. VIJAYARAHUL S

INTRODUCTION

Overview:

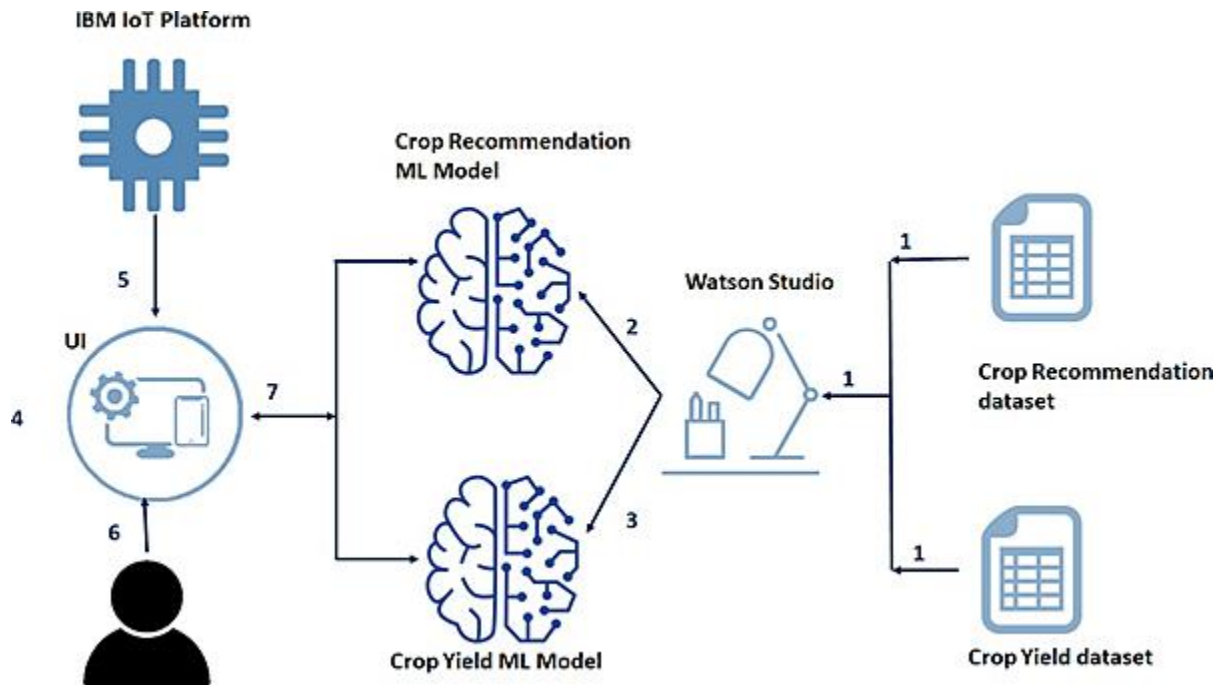
The objective of this project is (i) to create an application that recommends the farmers about the best crops to be cultivated based on climatic parameters, and also (ii) to predict the yield and revenue that would be generated for the cultivated land using Artificial Intelligence. The key challenges that a farmer faces are identifying the profitable crop, analysing the market demand, forecasting prices, and determining the optimal time for sowing and harvesting. All of which can be done faster with AI using predictive analytics. We have used separate datasets. For crop recommendation, we have used two models using LGBM classifier and Extra Trees classifier algorithms. For crop yield, we have used Snap Boosting Machine and Decision Tree regression models.

Purpose:

With this project, we aim to create an application that recommends the farmers about the best crops to be cultivated based on climatic parameters, and also to predict the yield and revenue that would be generated for the cultivated land using Artificial Intelligence.

THEORETICAL ANALYSIS:

Block Diagram:



Hardware/Software designing:

Hardware Requirements:

1. Processor: Minimum 1 GHz; Recommended 2GHz or more
2. A stable internet connection.(LAN or Wi-Fi).
3. Hard Drive: Minimum 32 GB; Recommended 64 GB or more
4. Memory (RAM): Minimum 1 GB; Recommended 4 GB or above

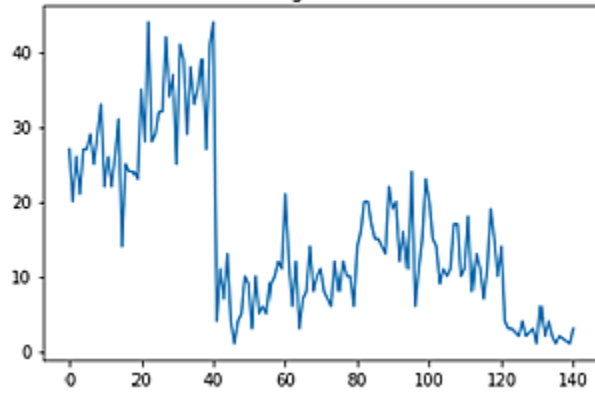
Software Requirements:

1. IBM Watson Studio
2. IBM Auto AI
3. IBM Machine Learning
4. IBM NodeRed Service
5. IBM Internet Of Things Platform
6. IBM Cloud

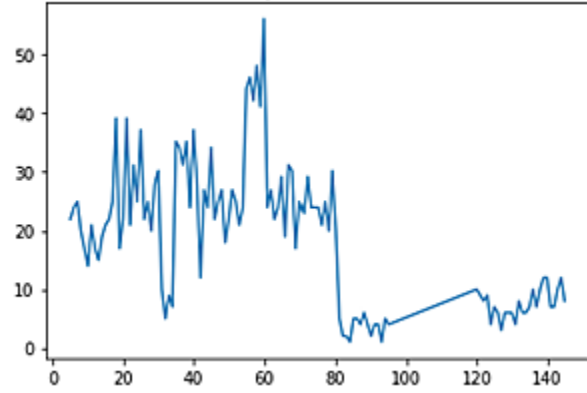
EXPERIMENTAL INVESTIGATIONS:

The datasets used for this project are downloaded from Kaggle and GitHub. On studying the datasets, we have a very good understanding of the features of both of the datasets. We have attached several graphs plotted using features from both the datasets.

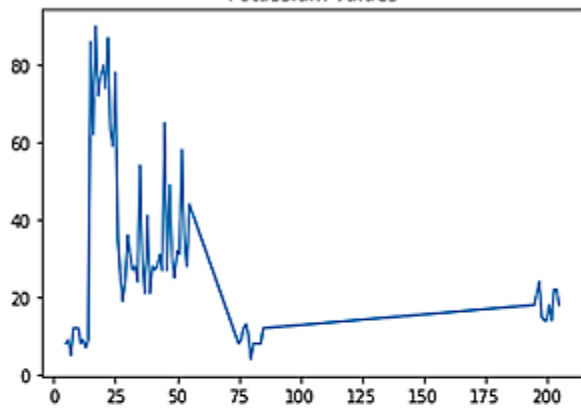
Nitrogen values



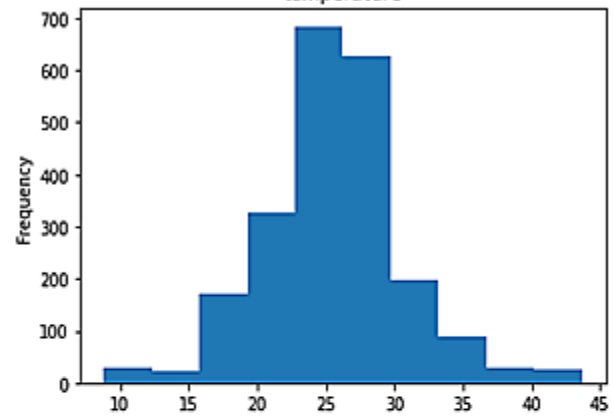
Phosphorous values



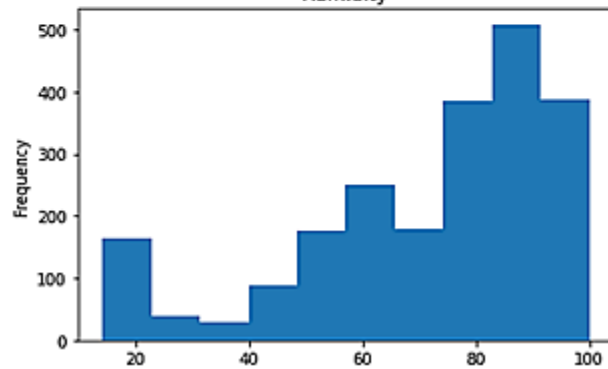
Potassium values



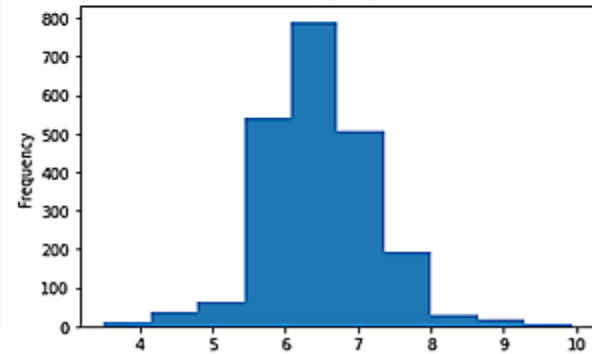
temperature



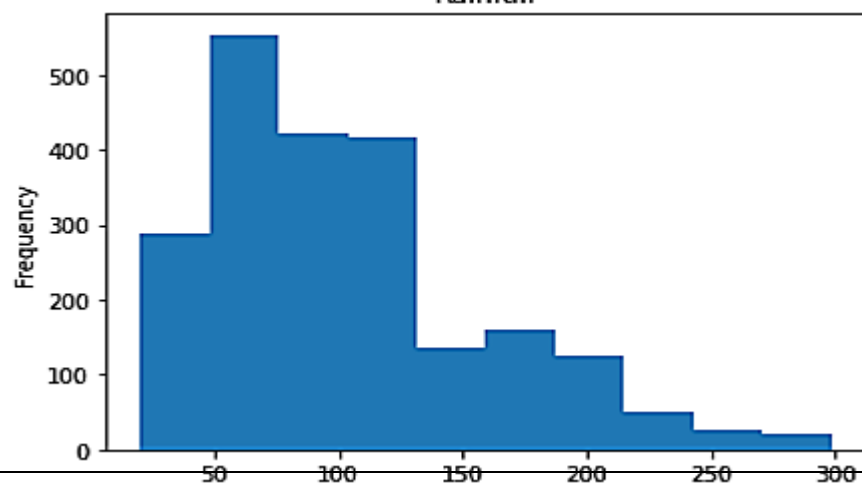
Humidity



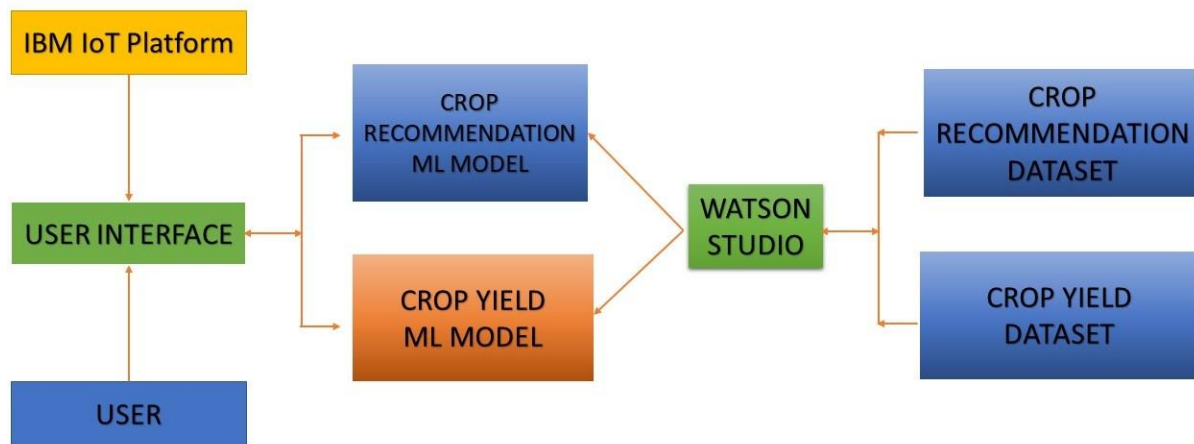
Ph scale



Rainfall



FLOWCHART:



ADVANTAGES AND DISADVANTAGES:-

Predictive analytics can be a real game-changer. Farmers can collect and process significantly more data and do it faster with AI than they would otherwise. Analyzing market demand, forecasting prices, and determining the optimal time for sowing and harvesting are key challenges farmers can solve with AI.

Combining artificial intelligence and agriculture can be beneficial for the following processes.

- a. Analyzing market demand- AI can simplify crop selection and help farmers identify what produce will be most profitable.
- b. Managing risk- Farmers can use forecasting and predictive analytics to reduce errors in business processes and minimize the risk of crop failures.
- c. Monitoring soil health- AI systems can conduct chemical soil analyses and provide accurate estimates of missing nutrients.
- d. Protecting crops- AI can monitor the state of plants to spot and even predict diseases, identify and remove weeds, and recommend effective treatment of pests.
- e. Harvesting- With the help of AI, it's possible to automate harvesting and even predict the best time for it.

Disadvantages are the fact that the datasets are quite pre-defined and the model doesn't have much to go on. There is also the fact that the model is not 100% accurate and it cannot quite match the experience of humans regarding sudden weather changes and changes in other natural factors required for farming.

LITERATURE SURVEY:

Existing Problem:

In present times, Indian farmers face a serious issue in the initial phases of crop production which is the very selection of the crops. Past records have proven that major losses incurred by farmers could have been avoided if only they had been aware of which crop is best suited for specific conditions. Its high time that this issue be countered using AI and ML.

Proposed Solution:

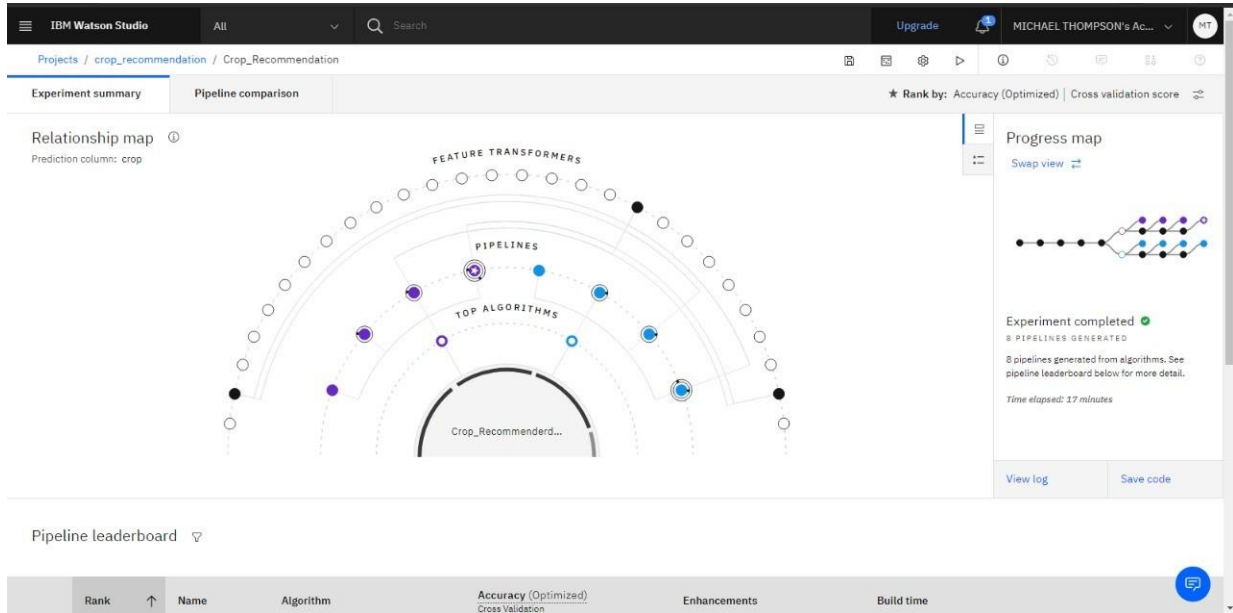
We have proposed a solution with which we can recommend the best crops to farmers, to be cultivated based on the climatic parameters, and also to predict the yield and revenue that would be generated for the cultivated land using Artificial Intelligence.

RESULT:

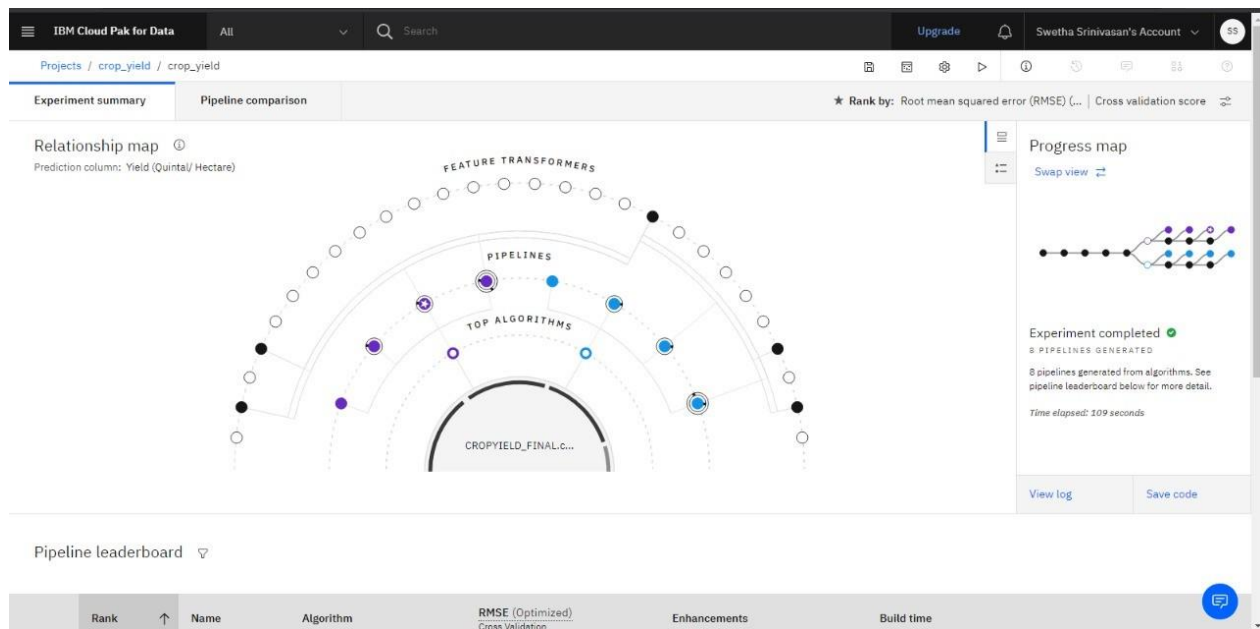
- Auto AI Model is successfully built using given datasets with an accuracy of 99.1%.
- Node Red has been downloaded using node red services - <https://nodered.org/docs/getting-started/windows>
- IoT Platform is integrated with Node Red Dashboard UI.

MACHINE LEARNING MODELS :

1. LGBM CLASSIFIER MODEL FOR CROP RECOMMENDATION



2. LINEAR REGRESSION MODEL FOR CROP YIELD:



APPLICATIONS:

- The system can be used to get suitable crop to sow in the field.
- The System can also be used to predict the crop yield.
- The System can be used to fetch IoT feed from IoT device which helps to monitor Soil and Weather condition.
- The modernization of farming can improve the society as a whole. Standing in the sun for hours in a day is no longer necessary if irrigation and fertilizer systems are automated.
- Automated Farming can be an upcoming industry which can create new jobs and increase the GDP and productivity of the nation leading to surplus.

CONCLUSION:

The proposed solution consists of the analysis done by IBM cloud-based service IBM Auto AI, and it recommends the crop to sow and estimate the yield. It displays output using the Node RED dashboard User Interface. Any user with understanding of Internet will be able to use this system.

FUTURE SCOPE:

- Suitable fertilizer and pesticide recommendation system can be implemented along with this system.
- In addition to this system, cultivation cost can also be predicted.
- Soil nutrient booster or fertilizer recommendation system will be beneficial if system detect any soil nutrient deficiency.
- Pest/Disease Detection using Cameras and Surveillance systems for crops so that farmers can be alerted on the presence of rodents/pests on their farms. This way, the damage caused by pests/diseases can be prevented before it happens.

BIBLIOGRAPHY:

Dataset for Crop Recommendation:

<https://www.kaggle.com/siddharthss/crop-recommendation-dataset>

Dataset for Crop Yield:

[https://github.com/shreyzo/Crop-yield-and-profitability-prediction/blob/main/crop production.csv](https://github.com/shreyzo/Crop-yield-and-profitability-prediction/blob/main/crop%20production.csv)

Videos uploaded in the smartinternz were very useful to us for revising the concepts and to learn new things.

[The SmartBridge - YouTube](#)

APPENDIX:

```
[
  {
    "id": "5affe66c.3f2f08",
    "type": "tab",
    "label": "Flow 1",
    "disabled": true,
    "info": ""
  },
  {
    "id": "b90884ef.584fe8",
    "type": "tab",
```



```

    "label": "Insurance_AutoAi",
    "disabled": true,
    "info": ""
  },
  {
    "id": "8d785186.03028",
    "type": "tab",
    "label": "Auto AI Crop Recommendation and Predictor",
    "disabled": false,
    "info": ""
  },
  {
    "id": "2669b84d.946b88",
    "type": "ui_base",
    "theme": {
      "name": "theme-dark",
      "lightTheme": {
        "default": "#0094CE",
        "baseColor": "#0096ff",
        "baseFont": "Arial,Arial,Helvetica,sans-serif",
        "edited": true,
        "reset": false
      },
      "darkTheme": {
        "default": "#097479",
        "baseColor": "#009679",
        "baseFont": "Arial Black,Arial Black,Gadget,sans-serif",
        "edited": true,
        "reset": false
      },
      "customTheme": {
        "name": "Untitled Theme 1",
        "default": "#4B7930",
        "baseColor": "#4B7930",
        "baseFont": "-apple-system,BlinkMacSystemFont,Segoe UI,Roboto,Oxygen-
Sans,Ubuntu,Cantarell,Helvetica Neue,sans-serif"
      },
      "themeState": {
        "base-color": {
          "default": "#097479",
          "value": "#009679",
          "edited": true
        },
        "page-titlebar-backgroundColor": {
          "value": "#009679",
          "edited": false
        },
        "page-backgroundColor": {
          "value": "#111111",
          "edited": false
        }
      },
    },
  },

```

```
"page-sidebar-backgroundColor": {
  "value": "#ffffff",
  "edited": false
},
"group-textColor": {
  "value": "#00e2b7",
  "edited": false
},
"group-borderColor": {
  "value": "#555555",
  "edited": false
},
"group-backgroundColor": {
  "value": "#333333",
  "edited": false
},
"widget-textColor": {
  "value": "#eeeeee",
  "edited": false
},
"widget-backgroundColor": {
  "value": "#009679",
  "edited": false
},
"widget-borderColor": {
  "value": "#333333",
  "edited": false
},
"base-font": {
  "value": "Arial Black,Arial Black,Gadget,sans-serif"
}
},
"angularTheme": {
  "primary": "indigo",
  "accents": "blue",
  "warn": "red",
  "background": "grey",
  "palette": "light"
}
},
"site": {
  "name": "AI:Crop Assisted Farming Dashboard",
  "hideToolbar": "false",
  "allowSwipe": "false",
  "lockMenu": "false",
  "allowTempTheme": "true",
  "dateFormat": "DD/MM/YYYY",
  "sizes": {
    "sx": 48,
    "sy": 48,
    "gx": 15,
```

```
        "gy": 6,  
        "cx": 6,  
        "cy": 6,  
        "px": 0,  
        "py": 0  
    }  
}  
},  
{  
    "id": "f509915.dea4f7",  
    "type": "ui_tab",  
    "name": "AI: Crop Assisted Farming",  
    "icon": "dashboard",  
    "order": 1,  
    "disabled": false,  
    "hidden": false  
},  
{  
    "id": "e615ce42.c77a3",  
    "type": "ui_group",  
    "name": "Crop Prediction",  
    "tab": "f509915.dea4f7",  
    "order": 1,  
    "disp": true,  
    "width": 6,  
    "collapse": false  
},  
{  
    "id": "6f7d8561.f7441c",  
    "type": "ui_group",  
    "name": "Yield_Prediction",  
    "tab": "f509915.dea4f7",  
    "order": 2,  
    "disp": true,  
    "width": "6",  
    "collapse": false  
},  
{  
    "id": "c1ab3da2.ef1f7",  
    "type": "ui_group",  
    "name": "Fertilizer_Prediction",  
    "tab": "f509915.dea4f7",  
    "order": 3,  
    "disp": true,  
    "width": 6,  
    "collapse": false  
},  
{  
    "id": "712c23ee.763f5c",  
    "type": "ui_group",  
    "name": "Real Time Weather Update",
```

```
"tab": "a8f8b5ad.c37748",
"order": 2,
"disp": true,
"width": 10,
"collapse": false
},
{
  "id": "a8f8b5ad.c37748",
  "type": "ui_tab",
  "name": "Real Time Data",
  "icon": "dashboard",
  "disabled": false,
  "hidden": false
},
{
  "id": "adb89bc3.5ac238",
  "type": "ui_group",
  "name": "PLOT",
  "tab": "a8f8b5ad.c37748",
  "order": 1,
  "disp": true,
  "width": 10,
  "collapse": false
},
{
  "id": "c047c851.677f48",
  "type": "ui_form",
  "z": "8d785186.03028",
  "name": "",
  "label": "",
  "group": "e615ce42.c77a3",
  "order": 1,
  "width": 0,
  "height": 0,
  "options": [
    {
      "label": "N",
      "value": "N",
      "type": "number",
      "required": true,
      "rows": null
    },
    {
      "label": "P",
      "value": "P",
      "type": "number",
      "required": true,
      "rows": null
    },
    {
      "label": "K",
```

```
    "value": "K",
    "type": "number",
    "required": true,
    "rows": null
  },
  {
    "label": "temperature",
    "value": "temperature",
    "type": "number",
    "required": true,
    "rows": null
  },
  {
    "label": "humidity",
    "value": "humidity",
    "type": "number",
    "required": true,
    "rows": null
  },
  {
    "label": "ph",
    "value": "ph",
    "type": "number",
    "required": true,
    "rows": null
  },
  {
    "label": "rainfall",
    "value": "rainfall",
    "type": "number",
    "required": true,
    "rows": null
  }
],
"formValue": {
  "N": "",
  "P": "",
  "K": "",
  "temperature": "",
  "humidity": "",
  "ph": "",
  "rainfall": ""
},
"payload": "",
"submit": "submit",
"cancel": "cancel",
"topic": "topic",
"topicType": "msg",
"splitLayout": "",
"x": 150,
"y": 160,
```

```

    "wires": [
      [
        "74afd1e6.7ede6",
        "ad23718f.a8847"
      ]
    ]
  },
  {
    "id": "74afd1e6.7ede6",
    "type": "debug",
    "z": "8d785186.03028",
    "name": "",
    "active": true,
    "tosidebar": true,
    "console": false,
    "tostatus": false,
    "complete": "false",
    "statusVal": "",
    "statusType": "auto",
    "x": 380,
    "y": 100,
    "wires": []
  },
  {
    "id": "ad23718f.a8847",
    "type": "function",
    "z": "8d785186.03028",
    "name": "Global variables for Form Node",
    "func":
      "global.set(\"N\",msg.payload.N)\nglobal.set(\"P\",msg.payload.P)\nglobal.set(\"K\",msg.payload.K)\nglo
      bal.set(\"temperature\",msg.payload.temperature)\nglobal.set(\"humidity\",msg.payload.humidity)\nglobal
      .set(\"ph\",msg.payload.ph)\nglobal.set(\"rainfall\",msg.payload.rainfall)\nvar
      apikey=\"iNnypAt8bUfX1Lp4HO-w-KwPl0z0i9XdiOldJuQOqB-E\"\nmsg.headers={\"content-
      type\":\"application/x-www-form-
      urlencoded\"}\nmsg.payload={\"grant_type\":\"urn:ibm:params:oauth:grant-
      type:apikey\", \"apikey\":apikey}\nreturn msg;",
    "outputs": 1,
    "noerr": 0,
    "initialize": "",
    "finalize": "",
    "libs": [],
    "x": 420,
    "y": 200,
    "wires": [
      [
        "f16a50a5.671db"
      ]
    ]
  },
  {
    "id": "f16a50a5.671db",

```

```

    "type": "http request",
    "z": "8d785186.03028",
    "name": "",
    "method": "POST",
    "ret": "obj",
    "paytoqs": "ignore",
    "url": "https://iam.cloud.ibm.com/identity/token",
    "tls": "",
    "persist": false,
    "proxy": "",
    "authType": "",
    "x": 640,
    "y": 120,
    "wires": [
      [
        "3ac45fe9.7cd67",
        "1efce9b7.e1ba86"
      ]
    ]
  },
  {
    "id": "3ac45fe9.7cd67",
    "type": "debug",
    "z": "8d785186.03028",
    "name": "",
    "active": true,
    "tosidebar": true,
    "console": false,
    "tostatus": false,
    "complete": "payload",
    "targetType": "msg",
    "statusVal": "",
    "statusType": "auto",
    "x": 780,
    "y": 60,
    "wires": []
  },
  {
    "id": "1efce9b7.e1ba86",
    "type": "function",
    "z": "8d785186.03028",
    "name": "pre-prediction",
    "func": "var N = global.get(\"N\")\nvar P = global.get(\"P\")\nvar K = global.get(\"K\")\nvar
temperature = global.get(\"temperature\")\nvar humidity = global.get(\"humidity\")\nvar ph =
global.get(\"ph\")\nvar rainfall = global.get(\"rainfall\")\nvar token =
msg.payload.access_token\nmsg.headers={ 'Content-Type': 'application/json',\\"Authorization\\":\\"Bearer
\\\"+token,\\"Accept\\":\\"application/json\\\" } \nmsg.payload={\\"input_data\\":[{\\"fields\\": [[\\"N\\", \\"P\\", \\"K\\",
\\"temperature\\", \\"humidity\\", \\"ph\\", \\"rainfall\\"]],\\"values\\":
[[N,P,K,temperature,humidity,ph,rainfall]]}]] \nreturn msg;",
    "outputs": 1,
    "noerr": 0,

```

```

    "initialize": "",
    "finalize": "",
    "libs": [],
    "x": 830,
    "y": 220,
    "wires": [
      [
        "435dcdad.04e964"
      ]
    ]
  },
  {
    "id": "435dcdad.04e964",
    "type": "http request",
    "z": "8d785186.03028",
    "name": "",
    "method": "POST",
    "ret": "obj",
    "paytoqs": "ignore",
    "url": "https://eu-gb.ml.cloud.ibm.com/ml/v4/deployments/176e8aaa-8d42-4ad3-8d41-
fc252837467e/predictions?version=2021-07-25",
    "tls": "",
    "persist": false,
    "proxy": "",
    "authType": "",
    "x": 990,
    "y": 140,
    "wires": [
      [
        "94608b04.7641f8",
        "234ecf81.4c636"
      ]
    ]
  },
  {
    "id": "94608b04.7641f8",
    "type": "debug",
    "z": "8d785186.03028",
    "name": "",
    "active": true,
    "tosidebar": true,
    "console": false,
    "tostatus": false,
    "complete": "payload",
    "targetType": "msg",
    "statusVal": "",
    "statusType": "auto",
    "x": 1110,
    "y": 80,
    "wires": []
  },

```



```
{
  "id": "234ecf81.4c636",
  "type": "function",
  "z": "8d785186.03028",
  "name": "",
  "func": "msg.payload=msg.payload.predictions[0].values[0][0]\nreturn msg;",
  "outputs": 1,
  "noerr": 0,
  "initialize": "",
  "finalize": "",
  "libs": [],
  "x": 1120,
  "y": 220,
  "wires": [
    [
      "47e17384.12d39c",
      "8bd74e74.78bac"
    ]
  ]
},
{
  "id": "47e17384.12d39c",
  "type": "debug",
  "z": "8d785186.03028",
  "name": "",
  "active": true,
  "tosidebar": true,
  "console": false,
  "tostatus": false,
  "complete": "false",
  "statusVal": "",
  "statusType": "auto",
  "x": 1170,
  "y": 300,
  "wires": []
},
{
  "id": "8bd74e74.78bac",
  "type": "ui_text",
  "z": "8d785186.03028",
  "group": "e615ce42.c77a3",
  "order": 2,
  "width": 0,
  "height": 0,
  "name": "",
  "label": "The recommended crop is:",
  "format": "{{msg.payload}}",
  "layout": "row-spread",
  "x": 1100,
  "y": 340,
  "wires": []
}
```

```
},
{
  "id": "f63f48af.d4c518",
  "type": "ui_form",
  "z": "8d785186.03028",
  "name": "",
  "label": "",
  "group": "6f7d8561.f7441c",
  "order": 1,
  "width": 0,
  "height": 0,
  "options": [
    {
      "label": "State_Name",
      "value": "State_Name",
      "type": "text",
      "required": true,
      "rows": null
    },
    {
      "label": "District_Name",
      "value": "District_Name",
      "type": "text",
      "required": true,
      "rows": null
    },
    {
      "label": "Crop_Year",
      "value": "Crop_Year",
      "type": "number",
      "required": true,
      "rows": null
    },
    {
      "label": "Season",
      "value": "Season",
      "type": "text",
      "required": true,
      "rows": null
    },
    {
      "label": "Crop",
      "value": "Crop",
      "type": "text",
      "required": true,
      "rows": null
    },
    {
      "label": "Area",
      "value": "Area",
      "type": "number",
```

```

        "required": true,
        "rows": null
    }
],
"formValue": {
    "State_Name": "",
    "District_Name": "",
    "Crop_Year": "",
    "Season": "",
    "Crop": "",
    "Area": ""
},
"payload": "",
"submit": "submit",
"cancel": "cancel",
"topic": "topic",
"topicType": "msg",
"splitLayout": "",
"x": 110,
"y": 480,
"wires": [
    [
        "f7d57b56.0e4a48",
        "2667311d.068ebe"
    ]
]
},
{
    "id": "f7d57b56.0e4a48",
    "type": "function",
    "z": "8d785186.03028",
    "name": "Global Variable for Yield Form Node",
    "func":
"global.set(\"State_Name\",msg.payload.State_Name)\nglobal.set(\"District_Name\",msg.payload.District
_Name)\nglobal.set(\"Crop_Year\",msg.payload.Crop_Year)\nglobal.set(\"Season\",msg.payload.Season)
\nglobal.set(\"Crop\",msg.payload.Crop)\nglobal.set(\"Area\",msg.payload.Area)\nvar
apikey=\"JkLj_aNFQdbB4RdgFdb6tAmKS6LIoEa68LwGVwt00oPA\"\\nmsg.headers={\"content-
type\": \"application/x-www-form-
urlencoded\"}\\nmsg.payload={\"grant_type\": \"urn:ibm:params:oauth:grant-
type:apikey\", \"apikey\": \"apikey\"}\\nreturn msg;\\n",
    "outputs": 1,
    "noerr": 0,
    "initialize": "",
    "finalize": "",
    "libs": [],
    "x": 360,
    "y": 540,
    "wires": [
        [
            "493d58d3.c95d38"
        ]
    ]
}

```

```
]
},
{
  "id": "1e81002a.72555",
  "type": "comment",
  "z": "8d785186.03028",
  "name": "Crop_Prediction",
  "info": "",
  "x": 140,
  "y": 80,
  "wires": []
},
{
  "id": "cdacffe2.2fb4d",
  "type": "comment",
  "z": "8d785186.03028",
  "name": "Yield_Prediction",
  "info": "",
  "x": 140,
  "y": 360,
  "wires": []
},
{
  "id": "493d58d3.c95d38",
  "type": "http request",
  "z": "8d785186.03028",
  "name": "",
  "method": "POST",
  "ret": "obj",
  "paytoqs": "ignore",
  "url": "https://iam.cloud.ibm.com/identity/token",
  "tls": "",
  "persist": false,
  "proxy": "",
  "authType": "",
  "x": 490,
  "y": 460,
  "wires": [
    [
      "7189cc2.8df2d34",
      "72af97f.69d2d68"
    ]
  ]
},
{
  "id": "2667311d.068ebe",
  "type": "debug",
  "z": "8d785186.03028",
  "name": "",
  "active": true,
  "tosidebar": true,
```

```

    "console": false,
    "tostatus": false,
    "complete": "payload",
    "targetType": "msg",
    "statusVal": "",
    "statusType": "auto",
    "x": 330,
    "y": 420,
    "wires": []
  },
  {
    "id": "7189cc2.8df2d34",
    "type": "debug",
    "z": "8d785186.03028",
    "name": "",
    "active": true,
    "tosidebar": true,
    "console": false,
    "tostatus": false,
    "complete": "false",
    "statusVal": "",
    "statusType": "auto",
    "x": 700,
    "y": 400,
    "wires": []
  },
  {
    "id": "72af97f.69d2d68",
    "type": "function",
    "z": "8d785186.03028",
    "name": "pre-prediction",
    "func": "var State_Name = global.get(\"State_Name\")\nvar District_Name =
global.get(\"District_Name\")\nvar Crop_Year = global.get(\"Crop_Year\")\nvar Season =
global.get(\"Season\")\nvar Crop = global.get(\"Crop\")\nvar Area = global.get(\"Area\")\nvar token =
msg.payload.access_token\nmsg.headers={ 'Content-Type': 'application/json',\n\"Authorization\": \"Bearer
\"+token,\n\"Accept\": \"application/json\" } \nmsg.payload={\n\"input_data\": [{\n\"fields\": [[\"State_Name\",
\"District_Name\", \"Crop_Year\", \"Season\", \"Crop\", \"Area\"]],\n\"values\":
[[State_Name,District_Name,Crop_Year,Season,Crop,Area]]}] } \nreturn msg;\n",
    "outputs": 1,
    "noerr": 0,
    "initialize": "",
    "finalize": "",
    "libs": [],
    "x": 690,
    "y": 520,
    "wires": [
      [
        "1c1e4c06.b632a4"
      ]
    ]
  },

```

```
{
  "id": "1c1e4c06.b632a4",
  "type": "http request",
  "z": "8d785186.03028",
  "name": "",
  "method": "POST",
  "ret": "obj",
  "paytoqs": "ignore",
  "url": "https://jp-tok.ml.cloud.ibm.com/ml/v4/deployments/1017d44d-18e6-4f18-be3f-93789a417f9a/predictions?version=2021-07-25",
  "tls": "",
  "persist": false,
  "proxy": "",
  "authType": "",
  "x": 870,
  "y": 480,
  "wires": [
    [
      "6946b2c6.f1183c",
      "f0e35abf.5699d8"
    ]
  ]
},
{
  "id": "6946b2c6.f1183c",
  "type": "function",
  "z": "8d785186.03028",
  "name": "",
  "func": "msg.payload=msg.payload.predictions[0].values[0][0]\\nreturn msg;",
  "outputs": 1,
  "noerr": 0,
  "initialize": "",
  "finalize": "",
  "libs": [],
  "x": 1040,
  "y": 520,
  "wires": [
    [
      "b8baed1d.06a04",
      "e1e32a70.ed1158"
    ]
  ]
},
{
  "id": "f0e35abf.5699d8",
  "type": "debug",
  "z": "8d785186.03028",
  "name": "",
  "active": true,
  "tosidebar": true,
  "console": false,
```

```
"tostatus": false,
"complete": "false",
"statusVal": "",
"statusType": "auto",
"x": 1050,
"y": 420,
"wires": []
},
{
  "id": "b8baed1d.06a04",
  "type": "debug",
  "z": "8d785186.03028",
  "name": "",
  "active": true,
  "tosidebar": true,
  "console": false,
  "tostatus": false,
  "complete": "false",
  "statusVal": "",
  "statusType": "auto",
  "x": 1210,
  "y": 540,
  "wires": []
},
{
  "id": "e1e32a70.ed1158",
  "type": "ui_text",
  "z": "8d785186.03028",
  "group": "6f7d8561.f7441c",
  "order": 2,
  "width": 0,
  "height": 0,
  "name": "",
  "label": "The yield is: ",
  "format": "{{msg.payload}}",
  "layout": "row-spread",
  "x": 1200,
  "y": 600,
  "wires": []
},
{
  "id": "9758e97b.e3d648",
  "type": "ui_template",
  "z": "8d785186.03028",
  "group": "c1ab3da2.ef1f7",
  "name": "",
  "order": 3,
  "width": 0,
  "height": 0,
```

```

    "format": "<div ng-bind-html=\"msg.payload\"></div>\n<style>\n  body{\nbackground-
image:url(\"https://www.macmillandictionary.com/external/slideshow/full/46528_full.jpg\");\n
}\n</style>",
    "storeOutMessages": true,
    "fwdInMessages": true,
    "resendOnRefresh": true,
    "templateScope": "local",
    "x": 460,
    "y": 300,
    "wires": [
      []
    ]
  },
  {
    "id": "89f8b802.cc13e8",
    "type": "comment",
    "z": "8d785186.03028",
    "name": "Fertilizer_Prediction for Small Scale Crops & Soil",
    "info": "",
    "x": 220,
    "y": 600,
    "wires": []
  },
  {
    "id": "19cb890d.de0437",
    "type": "ui_form",
    "z": "8d785186.03028",
    "name": "",
    "label": "",
    "group": "c1ab3da2.ef1f7",
    "order": 1,
    "width": 0,
    "height": 0,
    "options": [
      {
        "label": "Temparature",
        "value": "Temparature",
        "type": "number",
        "required": true,
        "rows": null
      },
      {
        "label": "Humidity ",
        "value": "Humidity ",
        "type": "number",
        "required": true,
        "rows": null
      },
      {
        "label": "Moisture",
        "value": "Moisture",

```



```
    "type": "number",
    "required": true,
    "rows": null
  },
  {
    "label": "Soil_Type",
    "value": "Soil_Type",
    "type": "text",
    "required": true,
    "rows": null
  },
  {
    "label": "Crop_Type",
    "value": "Crop_Type",
    "type": "text",
    "required": true,
    "rows": null
  },
  {
    "label": "Nitrogen",
    "value": "Nitrogen",
    "type": "number",
    "required": true,
    "rows": null
  },
  {
    "label": "Potassium",
    "value": "Potassium",
    "type": "number",
    "required": true,
    "rows": null
  },
  {
    "label": "Phosphorous",
    "value": "Phosphorous",
    "type": "number",
    "required": true,
    "rows": null
  }
},
"formValue": {
  "Temparature": "",
  "Humidity ": "",
  "Moisture": "",
  "Soil_Type": "",
  "Crop_Type": "",
  "Nitrogen": "",
  "Potassium": "",
  "Phosphorous": ""
},
"payload": "",
```

```

    "submit": "submit",
    "cancel": "cancel",
    "topic": "topic",
    "topicType": "msg",
    "splitLayout": "",
    "x": 110,
    "y": 720,
    "wires": [
      [
        "15829a31.cd2746",
        "80a0b64.dbe0848"
      ]
    ]
  },
  {
    "id": "15829a31.cd2746",
    "type": "debug",
    "z": "8d785186.03028",
    "name": "",
    "active": true,
    "tosidebar": true,
    "console": false,
    "tostatus": false,
    "complete": "false",
    "statusVal": "",
    "statusType": "auto",
    "x": 300,
    "y": 680,
    "wires": []
  },
  {
    "id": "80a0b64.dbe0848",
    "type": "function",
    "z": "8d785186.03028",
    "name": "Global Variables for Fertilizer Prediction",
    "func":
    "global.set(\"Temparature\",msg.payload.Temparature)\nglobal.set(\"Humidity\",msg.payload.Humidity)\nglobal.set(\"Moisture\",msg.payload.Moisture)\nglobal.set(\"Soil_Type\",msg.payload.Soil_Type)\nglobal.set(\"Crop_Type\",msg.payload.Crop_Type)\nglobal.set(\"Nitrogen\",msg.payload.Nitrogen)\nglobal.set(\"Potassium\",msg.payload.Potassium)\nglobal.set(\"Phosphorus\",msg.payload.Phosphorus)\nvar apikey=\"HoA0Yo_xpUx2TdyHHPPrJ6TjE9ViTQpm0NiFboAuEqENI\"\nmsg.headers={\"content-type\":\"application/x-www-form-urlencoded\"}\nmsg.payload={\"grant_type\":\"urn:ibm:params:oauth:grant-type:apikey\", \"apikey\":apikey}\nreturn msg;\n",
    "outputs": 1,
    "noerr": 0,
    "initialize": "",
    "finalize": "",
    "libs": [],
    "x": 410,
    "y": 780,
  }

```

```

    "wires": [
      [
        "9ae1e2c2.2268a"
      ]
    ]
  },
  {
    "id": "9ae1e2c2.2268a",
    "type": "http request",
    "z": "8d785186.03028",
    "name": "",
    "method": "POST",
    "ret": "obj",
    "paytoqs": "ignore",
    "url": "https://iam.cloud.ibm.com/identity/token",
    "tls": "",
    "persist": false,
    "proxy": "",
    "authType": "",
    "x": 580,
    "y": 700,
    "wires": [
      [
        "306c1e12.558a72",
        "c9dadf73.91264"
      ]
    ]
  },
  {
    "id": "306c1e12.558a72",
    "type": "debug",
    "z": "8d785186.03028",
    "name": "",
    "active": true,
    "tosidebar": true,
    "console": false,
    "tostatus": false,
    "complete": "false",
    "statusVal": "",
    "statusType": "auto",
    "x": 760,
    "y": 640,
    "wires": []
  },
  {
    "id": "c9dadf73.91264",
    "type": "function",
    "z": "8d785186.03028",
    "name": "pre-prediction",
    "func": "var Temperature = global.get(\"Temperature\")\nvar Humidity =
global.get(\"Humidity\")\nvar Moisture = global.get(\"Moisture\")\nvar Soil_Type =

```

```

global.get("Soil_Type")\nvar Crop_Type = global.get("Crop_Type")\nvar Nitrogen =
global.get("Nitrogen")\nvar Potassium = global.get("Potassium")\nvar Phosphorus =
global.get("Phosphorus")\nvar token = msg.payload.access_token\nmsg.headers={ 'Content-Type':
'application/json','Authorization':\"Bearer \"+token,\"Accept\": \"application/json\"}
\nmsg.payload={\"input_data\": [{\"fields\": [\"Temperature\", \"Humidity\", \"Moisture\", \"Soil_Type\",
\"Crop_Type\", \"Nitrogen\", \"Potassium\", \"Phosphorus\"]}, \"values\":
[[Temperature,Humidity,Moisture,Soil_Type,Crop_Type,Nitrogen,Potassium,Phosphorus]]]} \nreturn
msg;\n",
  "outputs": 1,
  "noerr": 0,
  "initialize": "",
  "finalize": "",
  "libs": [],
  "x": 770,
  "y": 760,
  "wires": [
    [
      "f2ffa81e.3f73b8"
    ]
  ]
},
{
  "id": "f2ffa81e.3f73b8",
  "type": "http request",
  "z": "8d785186.03028",
  "name": "",
  "method": "POST",
  "ret": "obj",
  "paytoqs": "ignore",
  "url": "https://jp-tok.ml.cloud.ibm.com/ml/v4/deployments/bbfefb3a-ed29-471f-adb9-
0d9c9ba8b751/predictions?version=2021-08-16",
  "tls": "",
  "persist": false,
  "proxy": "",
  "authType": "",
  "x": 870,
  "y": 860,
  "wires": [
    [
      "53758458.00c44c",
      "65220f71.55c6c"
    ]
  ]
},
{
  "id": "53758458.00c44c",
  "type": "debug",
  "z": "8d785186.03028",
  "name": "",
  "active": true,
  "tosidebar": true,

```

```
"console": false,
"toaststatus": false,
"complete": "false",
"statusVal": "",
"statusType": "auto",
"x": 990,
"y": 720,
"wires": []
},
{
  "id": "65220f71.55c6c",
  "type": "function",
  "z": "8d785186.03028",
  "name": "",
  "func": "msg.payload=msg.payload.predictions[0].values[0][0]\nreturn msg;",
  "outputs": 1,
  "noerr": 0,
  "initialize": "",
  "finalize": "",
  "libs": [],
  "x": 1050,
  "y": 880,
  "wires": [
    [
      "b7564439.b6bef8",
      "d60fe535.6bb118"
    ]
  ]
},
{
  "id": "b7564439.b6bef8",
  "type": "debug",
  "z": "8d785186.03028",
  "name": "",
  "active": true,
  "tosidebar": true,
  "console": false,
  "toaststatus": false,
  "complete": "false",
  "statusVal": "",
  "statusType": "auto",
  "x": 1220,
  "y": 820,
  "wires": []
},
{
  "id": "d60fe535.6bb118",
  "type": "ui_text",
  "z": "8d785186.03028",
  "group": "c1ab3da2.ef1f7",
  "order": 2,
```

```
"width": 0,
"height": 0,
"name": "",
"label": "The fertilizer for the respective Soil and Crop Type is:",
"format": "{{msg.payload}}",
"layout": "row-spread",
"x": 1350,
"y": 920,
"wires": []
},
{
  "id": "e6bb3a77.b00ba8",
  "type": "comment",
  "z": "8d785186.03028",
  "name": "Weather & Land",
  "info": "",
  "x": 130,
  "y": 880,
  "wires": []
},
{
  "id": "e5af8d57.15c82",
  "type": "openweathermap in",
  "z": "8d785186.03028",
  "name": "Bangalore",
  "wtype": "current",
  "lon": "",
  "lat": "",
  "city": "Bangalore",
  "country": "IN",
  "language": "en",
  "x": 180,
  "y": 1080,
  "wires": [
    [
      "bb1a3ee7.c5abf",
      "f3b4818d.8393d",
      "6632792b.1e5028",
      "533d4613.3f4a68",
      "a04d07c0.b41e88",
      "ba5e3d1e.7d8ef",
      "619232ef.db338c",
      "9d39d2cf.96692",
      "89a28168.0c43f"
    ]
  ]
},
{
  "id": "bb1a3ee7.c5abf",
  "type": "debug",
  "z": "8d785186.03028",
```

```
"name": "",
"active": true,
"tosidebar": true,
"console": false,
"tostatus": false,
"complete": "false",
"statusVal": "",
"statusType": "auto",
"x": 450,
"y": 1120,
"wires": []
},
{
  "id": "ba5e3d1e.7d8ef",
  "type": "ui_text",
  "z": "8d785186.03028",
  "group": "712c23ee.763f5c",
  "order": 5,
  "width": 0,
  "height": 0,
  "name": "",
  "label": "Atmospheric Pressure: ",
  "format": "{{msg.payload.pressure}} hPa",
  "layout": "row-spread",
  "x": 500,
  "y": 1060,
  "wires": []
},
{
  "id": "a04d07c0.b41e88",
  "type": "ui_text",
  "z": "8d785186.03028",
  "group": "712c23ee.763f5c",
  "order": 4,
  "width": 0,
  "height": 0,
  "name": "",
  "label": "Humidity:",
  "format": "{{msg.payload.humidity}}%",
  "layout": "row-spread",
  "x": 460,
  "y": 1020,
  "wires": []
},
{
  "id": "533d4613.3f4a68",
  "type": "ui_text",
  "z": "8d785186.03028",
  "group": "712c23ee.763f5c",
  "order": 3,
  "width": 0,
```

```

    "height": 0,
    "name": "",
    "label": "Temperature:",
    "format": "{{msg.payload.tempc}}°C",
    "layout": "row-spread",
    "x": 470,
    "y": 980,
    "wires": []
  },
  {
    "id": "6632792b.1e5028",
    "type": "ui_text",
    "z": "8d785186.03028",
    "group": "712c23ee.763f5c",
    "order": 2,
    "width": 0,
    "height": 0,
    "name": "",
    "label": "UV Index:",
    "format": "{{msg.payload.windspeed}}",
    "layout": "row-spread",
    "x": 460,
    "y": 940,
    "wires": []
  },
  {
    "id": "f3b4818d.8393d",
    "type": "ui_text",
    "z": "8d785186.03028",
    "group": "712c23ee.763f5c",
    "order": 1,
    "width": 0,
    "height": 0,
    "name": "",
    "label": "Weather:",
    "format": "{{msg.payload.detail}}",
    "layout": "row-spread",
    "x": 460,
    "y": 900,
    "wires": []
  },
  {
    "id": "619232ef.db338c",
    "type": "change",
    "z": "8d785186.03028",
    "name": "",
    "rules": [
      {
        "t": "set",
        "p": "template",
        "pt": "msg",

```



```

        "to": "<img src=\"http://openweathermap.org/img/w/{ {msg.payload.icon} }.png\">",
        "tot": "str"
    }
],
    "action": "",
    "property": "",
    "from": "",
    "to": "",
    "reg": false,
    "x": 520,
    "y": 1200,
    "wires": [
        [
            "1854c848.f4bb88"
        ]
    ]
},
{
    "id": "1854c848.f4bb88",
    "type": "ui_template",
    "z": "8d785186.03028",
    "group": "712c23ee.763f5c",
    "name": "Cloud",
    "order": 6,
    "width": 10,
    "height": 4,
    "format": "{{msg.template}}",
    "storeOutMessages": true,
    "fwdInMessages": true,
    "resendOnRefresh": true,
    "templateScope": "local",
    "x": 720,
    "y": 1200,
    "wires": [
        []
    ]
},
{
    "id": "9d39d2cf.96692",
    "type": "http request",
    "z": "8d785186.03028",
    "name": "",
    "method": "GET",
    "ret": "obj",
    "paytoqs": "ignore",
    "url":
"http://api.agromonitoring.com/agro/1.0/image/search?start=1619555836&end=1622147836&polyid=60b175af8f735b7274e327ac&appid=c5f92719bc183570e310c128be8d5859",
    "tls": "",
    "persist": false,
    "proxy": "",

```

```

    "authType": "",
    "x": 510,
    "y": 1260,
    "wires": [
      [
        "483a7307.b17b8c"
      ]
    ]
  },
  {
    "id": "89a28168.0c43f",
    "type": "http request",
    "z": "8d785186.03028",
    "name": "",
    "method": "GET",
    "ret": "obj",
    "paytoqs": "ignore",
    "url":
"http://api.agromonitoring.com/agro/1.0/polygons/60b15c3902b4dbb7a2c0e26e?appid=c5f92719bc18357
0e310c128be8d5859",
    "tls": "",
    "persist": false,
    "proxy": "",
    "authType": "",
    "x": 510,
    "y": 1300,
    "wires": [
      [
        "5a1c4f49.f2d0e"
      ]
    ]
  },
  {
    "id": "483a7307.b17b8c",
    "type": "change",
    "z": "8d785186.03028",
    "name": "",
    "rules": [
      {
        "t": "set",
        "p": "template",
        "pt": "msg",
        "to": "<img src=\"{{msg.payload[0].image.dswi}}\" width=\"200\">",
        "tot": "str"
      }
    ],
    "action": "",
    "property": "",
    "from": "",
    "to": "",
    "reg": false,

```

```
"x": 730,
"y": 1260,
"wires": [
  [
    "f6ea4aad.8b4cd8"
  ]
]
},
{
  "id": "f6ea4aad.8b4cd8",
  "type": "ui_template",
  "z": "8d785186.03028",
  "group": "adb89bc3.5ac238",
  "name": "PLOT",
  "order": 1,
  "width": 10,
  "height": 5,
  "format": "{{msg.payload}}",
  "storeOutMessages": true,
  "fwdInMessages": true,
  "resendOnRefresh": true,
  "templateScope": "local",
  "x": 940,
  "y": 1260,
  "wires": [
    []
  ]
},
{
  "id": "5a1c4f49.f2d0e",
  "type": "ui_text",
  "z": "8d785186.03028",
  "group": "adb89bc3.5ac238",
  "order": 2,
  "width": 0,
  "height": 0,
  "name": "",
  "label": "Land Size: ",
  "format": "{{msg.payload.area}} ha",
  "layout": "row-spread",
  "x": 740,
  "y": 1320,
  "wires": []
},
{
  "id": "54a5c0f2.527e6",
  "type": "ui_template",
  "z": "8d785186.03028",
  "group": "712c23ee.763f5c",
  "name": "",
  "order": 7,
```

```
    "width": "0",
    "height": "0",
    "format": "<div ng-bind-html=\"msg.payload\"></div>\n<style>\n  body{\nbackground-
image:url(\"https://www.theindiaforum.in/sites/default/files/field/image/2021/05/28/ramkumar-
radhakrishnan-wikimedia-1622193304.jpeg\");\n  }\n</style>",
    "storeOutMessages": true,
    "fwdInMessages": true,
    "resendOnRefresh": true,
    "templateScope": "local",
    "x": 210,
    "y": 1220,
    "wires": [
      []
    ]
  }
]
```