Task 02 : Automating irrigation system

Outline:

Before this task we have already prepared the growing medium and set up our troughs in which we have started planting our seeds.

To get them fed and watered, in this task we get our Raspberry PI and wireless valve configured and connected. To complete this task the following components are required, and a step-by-step sequence of instructions is provided, along with necessary tutorials for this Task.

Automating our Agriculture testbed:

The first component in the process of automating the testbed is controlling the irrigation for the troughs.

Wireless Valve for Automating Irrigation:

In our design we have automated irrigation for different test-beds in order to schedule the turning ON/OFF of a solenoid valve.

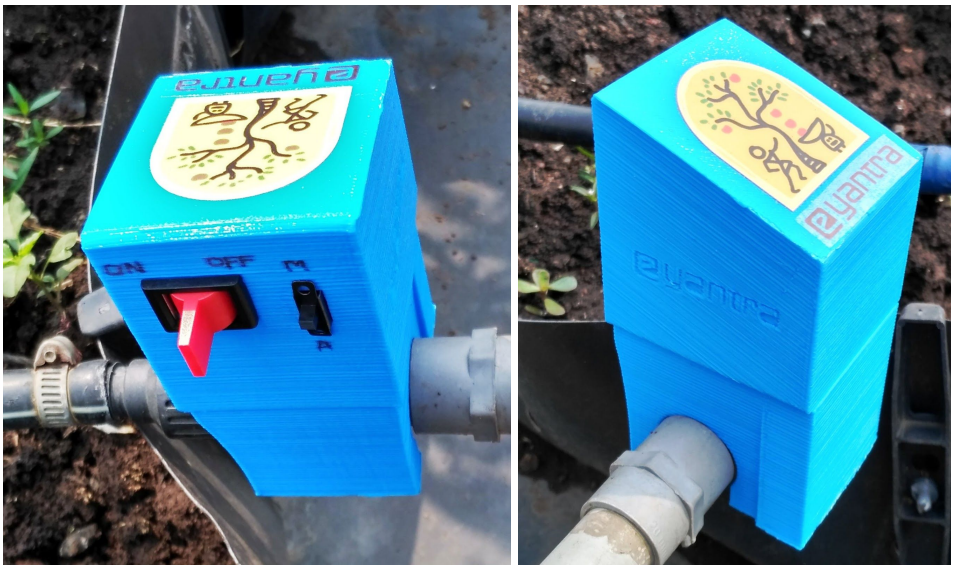

Figure 1 : Wireless Valve

Description :

This wireless valve consists of the following :

1) **Solenoid Valve:**

This is an electromechanical valve that can turn ON/OFF the water supply to the drip irrigation system. Typically solenoid valves turn ON or open when supply voltage (DC) is applied and turn OFF when power is removed. However, We have used a latching solenoid valve i.e. it is turned ON by applying a supply voltage pulse after which it remains ON even in the absence of supply voltage. On the contrary the valve can be turned OFF just by reversing the polarity of the supply voltage.

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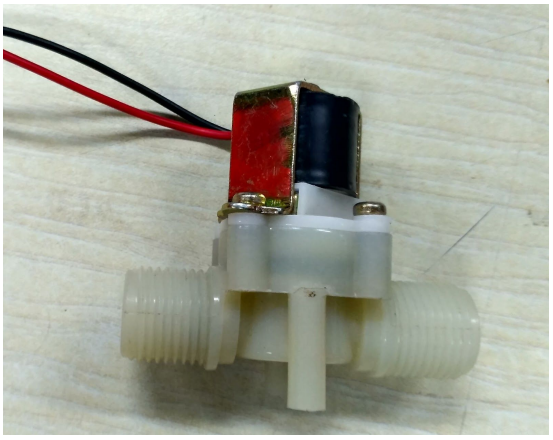

Figure 2 : Latching Solenoid Valve

2) Controller board:

The controller board houses the following :

a) ESP8266 - 07 :

This is a WiFi chip manufactured by Espressif Systems along with an on board 32 bit micro controller from Tensilica. This chip essentially provides a wirelessly networkable low cost microcontroller.

Figure 3 : ESP8266-07

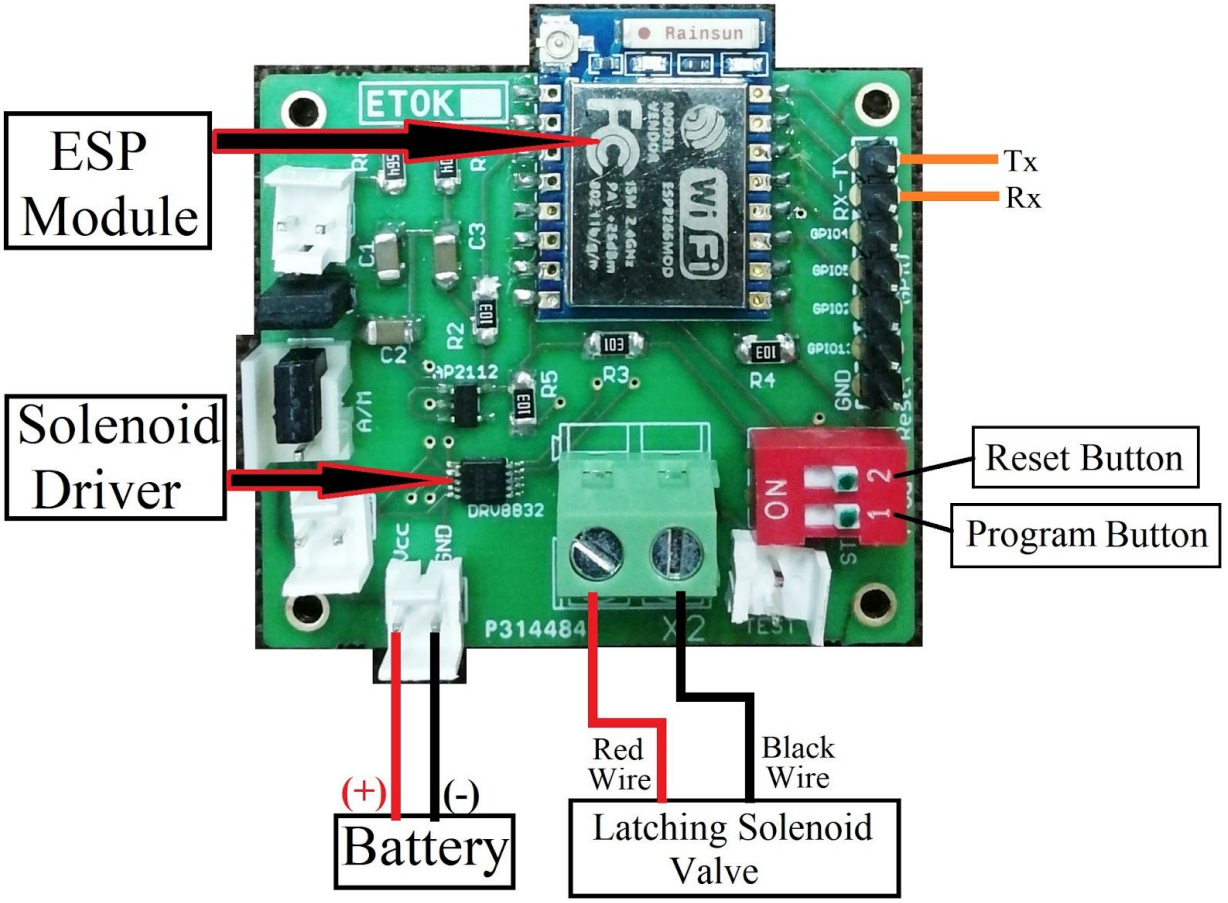

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Figure 4 : Controller board

b) Program and Reset switches:

These switches enable a user to load their own programs on the controller. More information about them will be given in subsequent tasks.

c) Power Supply Connections and Solenoid Driver :

ESP8266 works on a DC supply range of 2.8 - 3.6 V, while the valve requires 4.5 - 6V for its operation. The Solenoid driver IC is responsible for switching the polarity of the supply for the latching solenoid valve.

3) Battery Pack and Protective Casing:

There is a 3.7V, 3000mAh Lithium ion battery provided along with a protective casing for the device.

Figure 5 : Battery

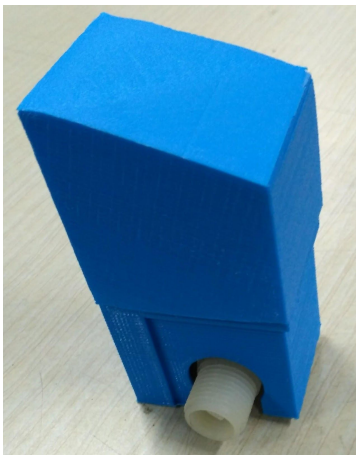

Figure 6 : Protective Casing

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Checkpoint 1 :

Connecting/Assembling your Wireless Valve

1. Connect the solenoid valve terminals (as indicated in Figure 4) with Connector 2 using a screwdriver

2. Connect the battery terminals to the slot for battery. Make sure to connect it in correct polarity order with positive terminal connected to Vcc and negative terminal connected to Gnd.

Checkpoint 2:

How to connect with ESP and test your valve controller.

Step 1. After making all of the connections as instructed turn the toggle switch towards the Auto Mode indicated by “A” mark on the casing of the valve. This will turn ON the valve controller, you will notice the ESP8266-07 LEDs flashing twice, indicating that it is correctly powered and ready to use.

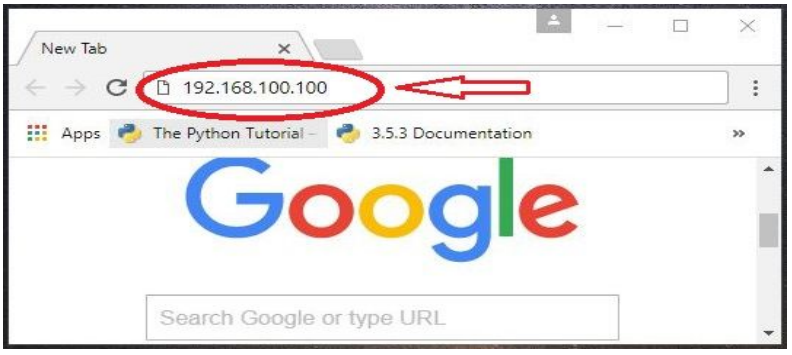
Note: On the first boot the valve controller will start in AP mode (i.e. Access Point mode).

Step 2. Now open your laptop or your smart phone and search for a wifi named as **“k-Yantra_Valve”.**

Step 3. Connect to the wifi network named **“k-Yantra_Valve”** using the password **“efsi1234”.**

Step 4. As soon as your laptop/phone is connected to **“efsi-valve”** wifi network, open a browser in your device (Chrome or Internet Explorer preferably).

Step 5. Now type **192.168.100.100** in the address bar of opened browser and press enter.



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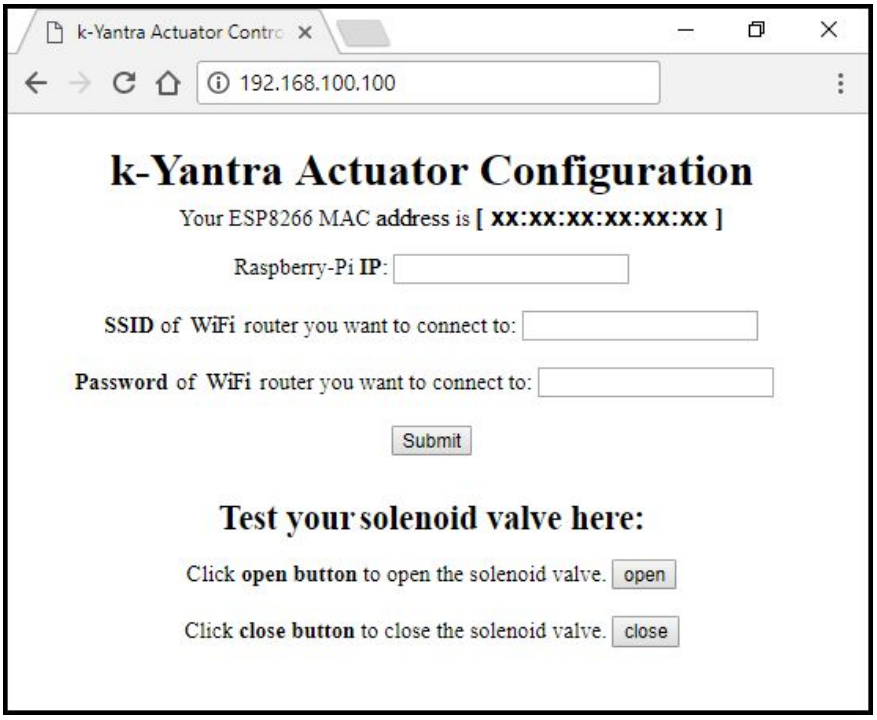
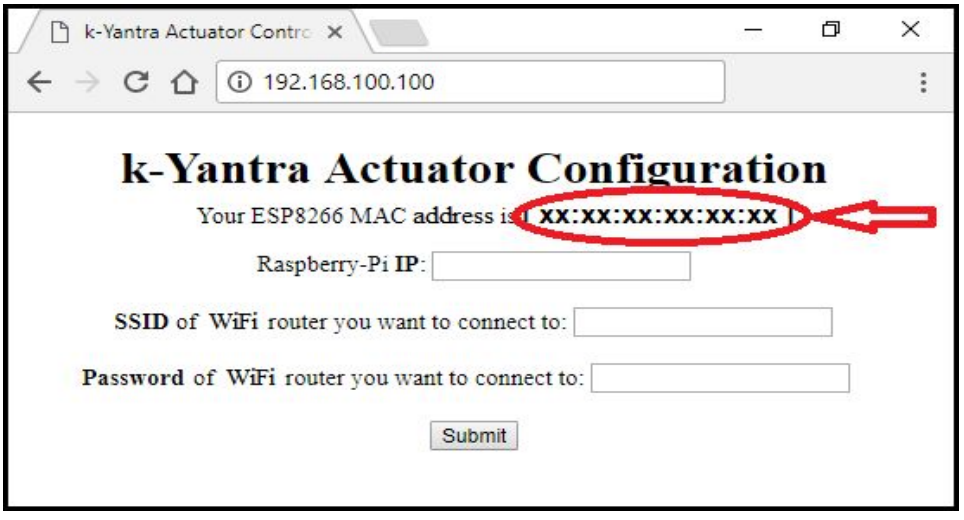
Step 6. A web page will open in the browser as shown below. (Note: This web page is hosted by the ESP8266 itself)



Step 7. On the web page you will notice a line as **"Your ESP8266 MACID is [XX:XX:XX:XX:XX:XX]".** Note down this MAC ID for future reference.



Step 8. Now put the IP address of your Raspberry-Pi in the first field and SSID & Password in the second & third field respectively on this web page. Then click "Submit" button.

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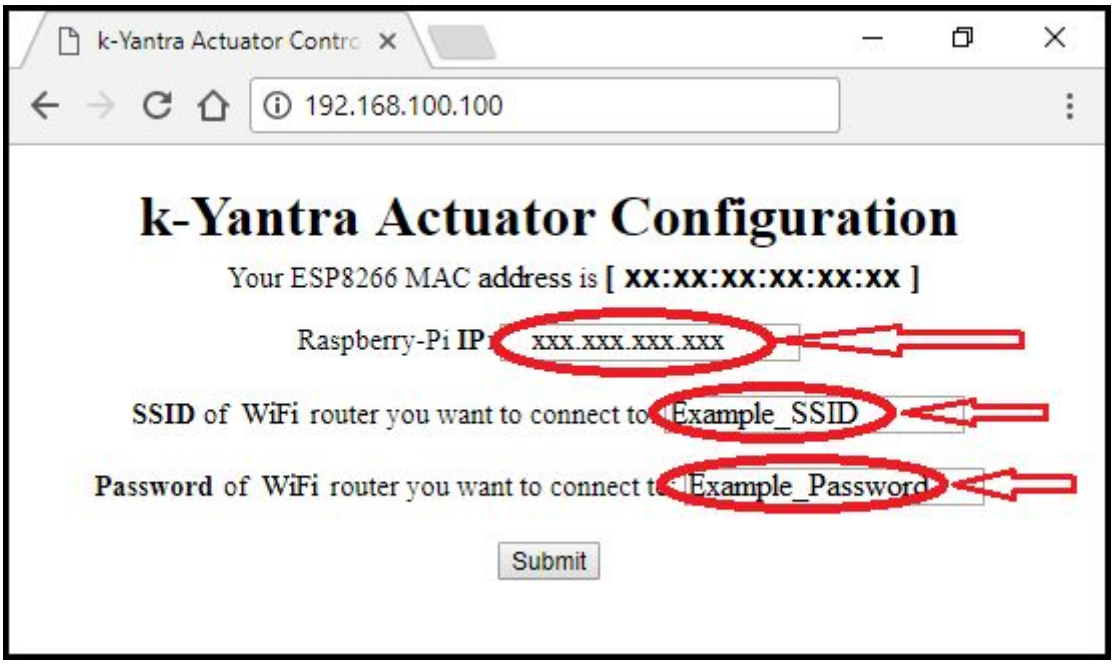

Step 9. Once you click on “Submit” button, the valve controller will automatically switch from AP mode to STA mode (i.e. Station mode) and the WiFi network named “k-Yantra_Valve” will disappear.

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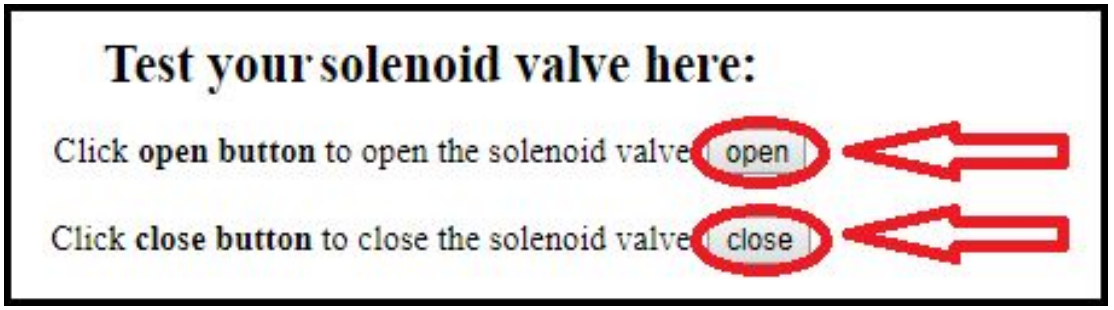
Step 10. On this web page under the heading **“Test your solenoid valve here:”** there will be two buttons visible, named as **“Open”** and **“Close”.**



Step 11. In order to test whether your controller board is able to control the solenoid valve, click on **“Open”** and **“Close”** buttons alternatively to observe the opening and closing of solenoid valve accordingly. There will be a distinct “click” sound when the valve opens.

Note: Always make sure that the device on which your are opening the webpage is connected to wifi **“efsi-valve”.**

Note: To change the settings done in **Steps 5 to 9** you have to switch back the mode of valve controller to AP mode from STA mode. In order to do that follow the steps given below.

Step 1: Switch ON and OFF the the “Reset” switch once (i.e. Switch 2 on the DIP switch).

Step 2: Then immediately switch ON the “Program” switch (i.e. Switch 1 on the DIP switch).

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Please refer to following table of images as visual illustration of the process explained above:

			
Both Switches OFF	Switch 2 ON	Switch 2 OFF	Switch 1 ON

In the next step we learn how to configure our valve to connect to the k-Yantra server through the internet.

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