8 digit internet connected display (loaded with NTP clock / YouTube stats firmware)

*1) Completed unit in an example enclosure*

Introduction

This unit is an universal 8 digit internet connected display which could be used for a number of things but in this documentation it is loaded with firmware to display the time from the NTP time service and also provide YouTube statistics of your channel showing subscriber count and total video view count. Due to YouTube's limitations implemented in 2019 the counter will only show exact numbers of subscribers up to 999. After that it will begin rounding them down on a sliding scale starting with the lowest 10. For example 1234 subscribers will show as 1230 and 12345 subscribers will show as 12300 subscribers. Hence this product is suitable for small channels and producers who want to keep an eye on their subscribers as well as know the time!

The counter works by connecting to the internet through an ESP8266 WiFi module which has a 32 bit RISC-V CPU onboard running at 80Mhz with some spare flash space for user programs which can be programmed in C++ or Python. This is where the firmware for operation is stored. An ICM7228 display driver chip handles the multiplexing and display blanking and drives 8 common anode high efficiency displays directly without the need for current limiting resistors.

If you have purchased one of these from my Tindie or Ebay store thanks for your purchase and enjoy your statistics display. You can contact me for support at adrian-smith31@clara.co.uk if you need any help with it.

Operation

When the unit is configured and first powered on it will do a brief display test (show 88888888) followed by 8 dashes indicating it is connecting to the WiFi network. If successful it will then show the last two octets of the local IP address then go directly to the clock display. If unsuccessful it will show **–HELP--** to indicate it cannot connect to the network or the network isn't configured. You can check the serial diagnostic output (see below) for troubleshooting if required.
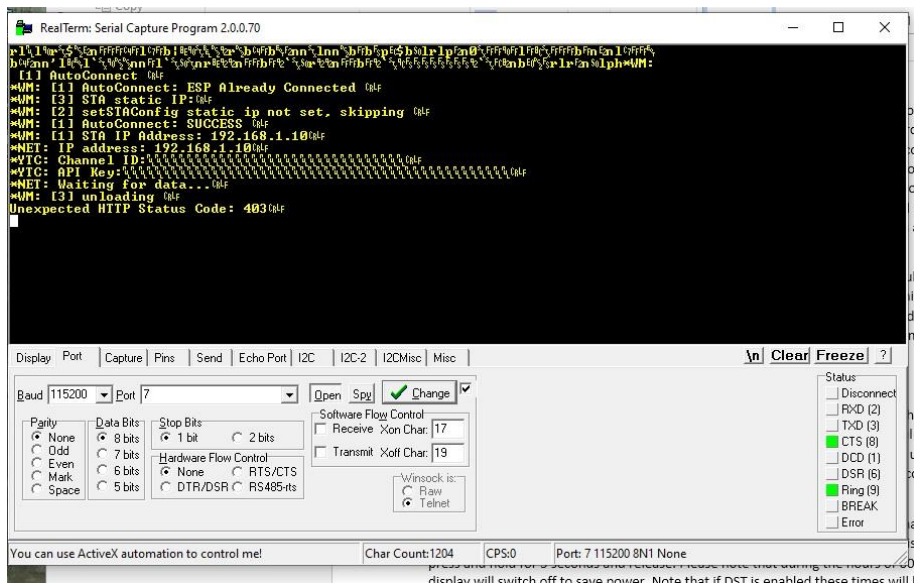
2) Example diagnostic output showing an error. In this case YouTube credentials not set.

A button connected to the 3 pin connector on pins 1&2 selects the mode and enables / disables daylight saving time. To switch modes briefly press the button and to enable / disable DST mode press and hold for 5 seconds and release. Repeat to turn off DST and vice versa. Please note that during the hours of 00:00 and 06:00 the display will switch off to save power. Note that if DST is enabled these times will be out by one hour.

There is a serial port on the unit through the built in RS232-USB converter so if you connect the unit to a computer and open a serial terminal there will be diagnostics and other information sent to the terminal. Serial settings are 115200,8,N,1. You can use a terminal emulator program such as Realterm (pictured) or terraterm. You can also use the Arduino serial monitor with the appropriate ESP8266 support added to the Arduino IDE.

Set-up procedure

The first step is to obtain a YouTube API key. This is needed to for the firmware to access your channel statistics; basically it is a unique key given to a device to authorise access to your data. In
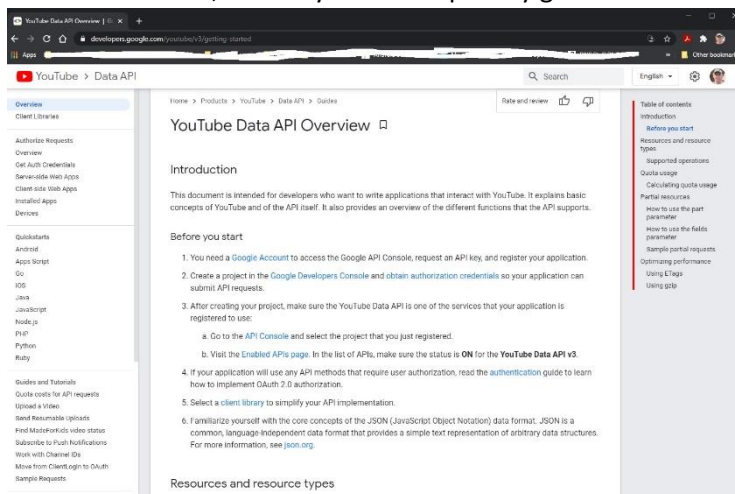
this case only public data is being accessed rather than private. Google does offer this through the OAuth2.0 method but that is not supported by this device. You will need to create a project on the Google developer's page (it's free) and follow the instructions for obtaining a key and giving it credentials to access your statistics. You only need a public key; you can ignore the OAuth2.0 things. The key type you need is a YouTube Data API V3 and set for webserver configuration e.g. node.js or Tomcat. The direct link to the example page

*3) Google API configuration page*

shown is here. https://developers.google.com/youtube/registering_an_application
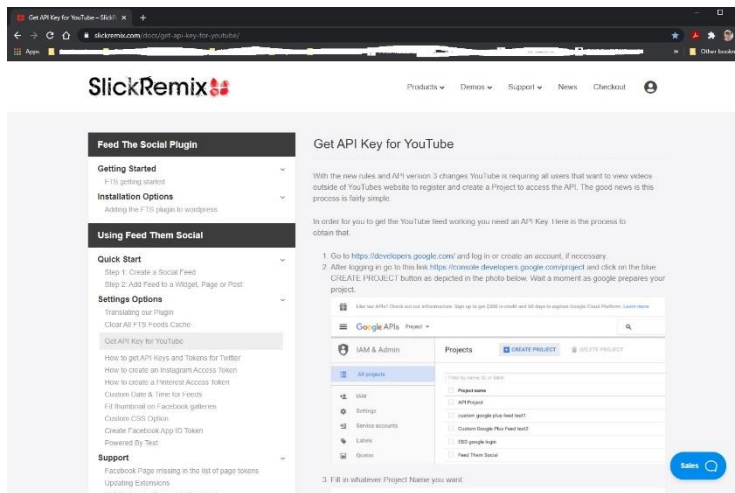
4) API set up instructions

There is a good tutorial you can go to at https://www.slickremix.com/docs/get-api-key-for-youtube/ which is an excellent site. Please note that without the API key this product will not function.

Once you have obtained your API key it is time to connect your statistics display / clock to the internet. This requires a WiFi connection on the 2.4Ghz band (5Ghz is not supported) and operates with the wireless-N standard. Power up your display and wait till it shows –HELP—then you will need to grab a smartphone or tablet and connect to the new wireless network "YTcounterAP" and when
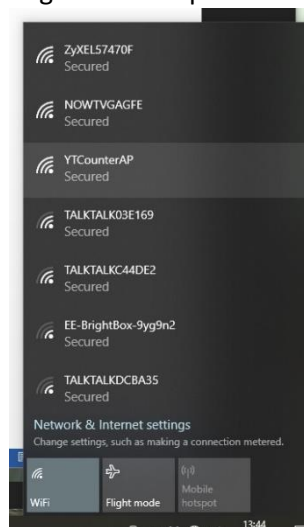
prompted for the password / network key enter "password" all lower case. It is much easier on a smartphone but it can be done with a laptop too. If using your laptop disconnect from your existing connection and connect to the YTcounterAP network. If you are not directed automatically to a WiFi configuration page go to IP address 192.168.4.1 in your favourite web browser.

In the left example I used a Windows 10 system. Connect to the network and you will be taken to a web page at 192.168.4.1 and click on configure WiFi. If any existing networks are configured they will be shown below the blue configuration buttons. When you have clicked on configure WiFi you will be taken to the screen below which shows a list of detected wireless networks in range. If any existing network configuration is set it will look like the example below but obviously it will show a different SSID

5) WiFi network SSID

to mine otherwise on a new device the boxes will be blank. Click on your WiFi network in the list and it will automatically fill in the SSID box. If not, type it manually into the box.

Then once you have done that enter your WiFi router's password (also called passphrase or network key on some routers) and click save. The device will restart and the YTcounterAP access point will disappear and if successful at connecting the clock will show the current time or 00-00-00 if the NTP server didn't respond in time. If that happens it will auto sync on the hour or you can reboot the device to try again. If the display goes back to –HELP—check that you have entered your wireless network password / passphrase correctly.
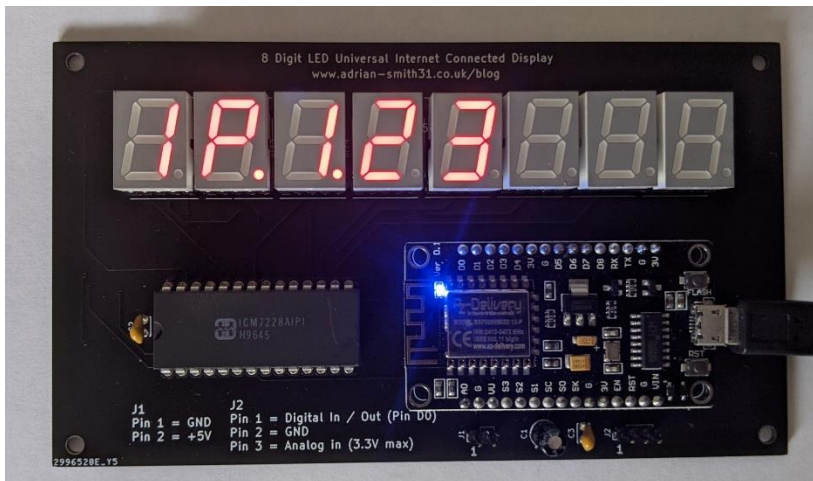

6) WiFi config screen

Now the next step is to configure the counter so it can access your YouTube statistics. Reboot the device to obtain the local IP address. When the device is booting it will briefly show the last two octets of the IP address as in the below picture. In this case it is 192.168.1.23.


7) IP address display

Most home routers start with 192.168 so if say 0.3 is displayed your IP address will be 192.168.0.3. Corporate networks use 10.0 or 172.16x. so bear this in mind if you are using a business class router. You can check your IP configuration in windows by going to the command prompt and typing "ipconfig" which will return the local IP address of your computer. So if it starts with 192.168 then you will need to put that before what is displayed on the LED display of the statistics counter.

Now open up a web browser and go to the IP address obtained above and you will get the below screen if all goes well. It may take a few seconds to load.
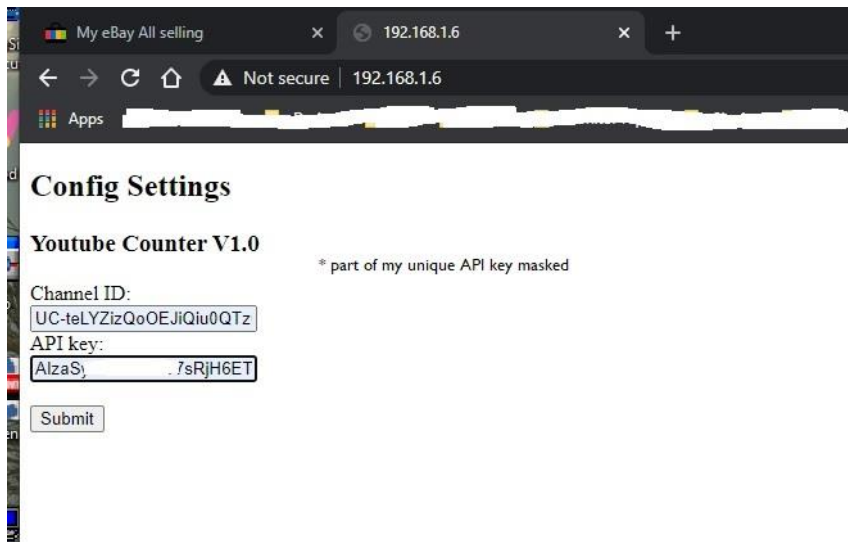
8) Credentials configuration page

Now enter your YouTube channel ID and the API key you obtained in step 1 and click on submit. Wait for confirmation and then reboot your counter by powering it off and on again.
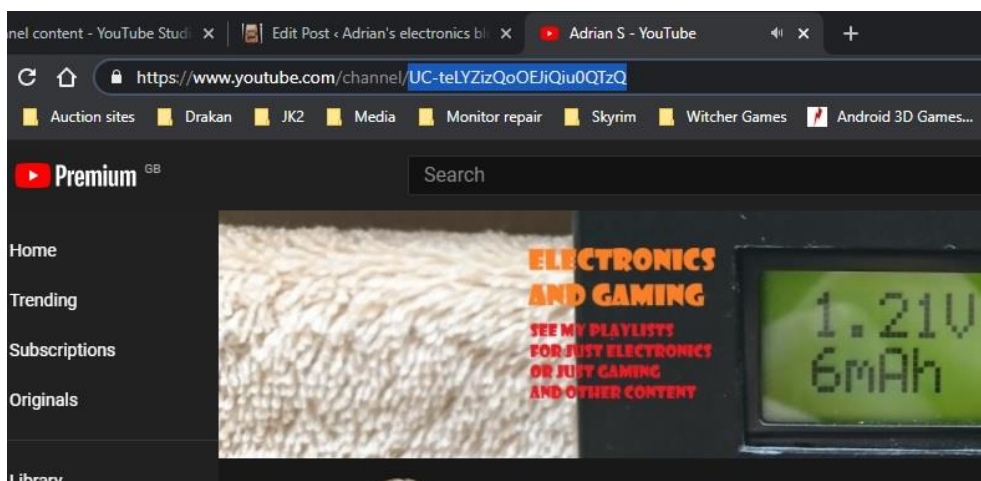
9) The YouTube Channel ID you want to monitor

If all goes well the current time will be displayed and pressing the button connected between pin 1 and 2 (or rear of unit if you bought the cased version) will cycle through subscribers, total video views and current time.

Troubleshooting

1) *The display is blank* – There is no power or the time is between midnight and 6am; the device will turn off the display automatically to save power. The only exception is if it is unable to obtain the time from the NTP server.

2) *Clock shows 00-00 or incorrect time* – the NTP server is down or access to it is being blocked by your firewall or network configuration. If it is an hour out DST is active. Press and hold the rear button for 5 seconds then release to turn it off.

3) *YouTube stats show 0* – YouTube credentials not set up or incorrect. There could be a problem with YouTube's servers. Check the serial diagnostic output for further troubleshooting. Error 400 is

incorrect or no API key. Error 403 is access denied; check your firewall configuration or you are not trying to view someone else's channel. Also your channel ID could be set incorrectly.

4) *Not secure is shown on the configuration pages* – This is normal as the web page is not on the internet; they are local web pages stored on the ESP8266 firmware.

5) *The device reboots randomly* – USB power supply is insufficient. Please make sure that the USB power supply can supply at least 700mA.

6) *Will not connect to WiFi* – Insufficient USB power, incorrect WiFi credentials, WiFi interference.

7) *The display shows –HELP—and will not boot* – Not connected to the WiFi network. Check it is working or configured correctly. Check the serial diagnostic output for further troubleshooting.

8) *View statistics are slightly out compared to my YouTube about page* – This is a known YouTube issue. View counts can be out of sync between YouTube.com, the API and the YouTube app. Subscriber counts are always up to date. The counter updates every 5 minutes.

9) *Subscriber counts above 999 always show 0 for the last digit* – This is the YouTube API that rounds down to the nearest 10 on a sliding scale. E.g. 1234 subscribers will show as 1230. You will notice on your YouTube about page it will show 1.23K subscribers instead of the exact number.