CC32xx Websock Camera Application

Objective

This application demonstrates the real time streaming capability of websocket protocol. We capture VGA frames using camera sensor and send it over websocket to the client.

Prerequisites

Hardware

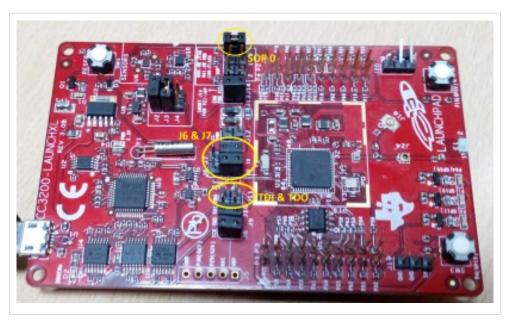
- CC3200 LaunchPad Rev 3.2 onwards
- CC3200 Camera Booster Pack Rev 3.0 onwards
- MT9D111 Camera Module

Software

- CC3200 WebSocket application
- Latest SDK Firmware Package

Configuring the target device

- Ensure SOP 0 is mounted on the CC3200 launchpad. Make sure to remove the same and mount SOP 2 while flashing the binary application. Since, TDI and TDO are used for I2C interface, the JTAG is operational in SWD mode.
- 2. Since SWD mode is used, make sure to un-mount J10 and J11 jumpers so that TDI and TDO lines are not being used.
- 3. Mount the jumpers J6 and J7 in the RX/TX mode. This enables the launchpad interface to the booster pack.



4. Mount the Camera Booster pack on the launchpad as shown below. Make sure the VCC on P1 connector mates with VCC indication on the booster pack. Similarly, the GND on P2 connector should align with GND indication on the camera booster pack.



5. Please note that only one sensor has to be interfaced to the camera booster pack.

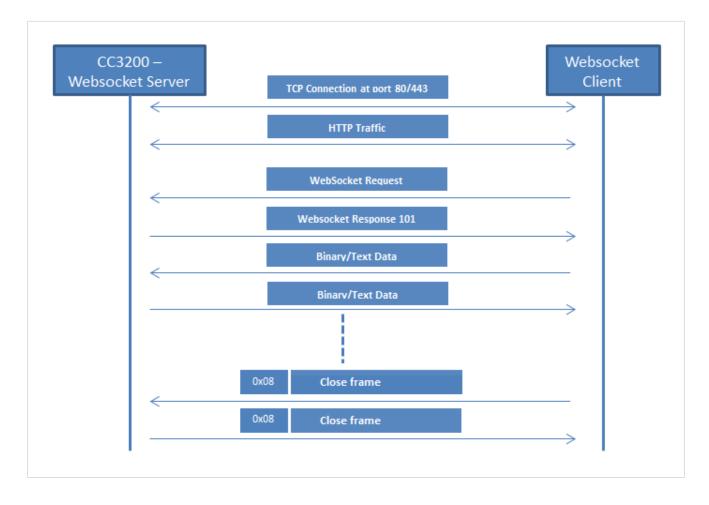
Application details

In this application, Simplelink device comes up in AP Mode. User needs to connect the Wi-Fi enabled device PC/Smartphone to the device AP (Default SSID: mysimplelink-MACAddr) Using a web browser, access mysimplelink.net, the static pages stored on SFLASH will be displayed. The web page will ask for the URL of the CC3200. Enter this and send 'Start'. Wait for the alert window to confirm connection. Send Capture command to device. The video streaming will now start. You can choose to send 'Stop' at any time. The streaming can be restarted by repeating the same process again. The following picture illustrates the usage of the camera application:



Websocket Camera Application Sequence

- 1. Client makes TCP Connection with Websocket Server at port 80/443.
- 2. The client initiates a websocket handshake by sending an upgrade request.
- 3. Websocket Server responds with Response code 101 if handshake is successful.
- 4. Client sees an alert on web page saying connection is established.
- 5. The client sends a capture command after which the device starts sending the JPEG frames as binary data without any polling from client.
- 6. Client closes connection by sending a close frame.



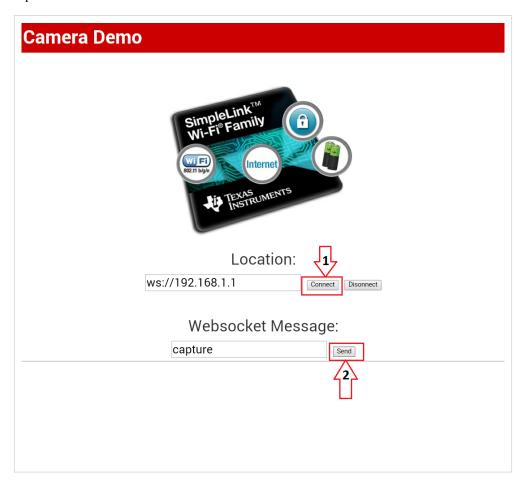
Source Files briefly explained

- main.c System Initialization, Spawns the HTTPServer Task
- httpserverapp.c Starts simplelink. Configures CC3200 in AP mode. Starts the Http server. Handles all websocket callbacks. Camera application is called from the callback.
- gpio_if.c Handles GPIO related operations
- pinmux.c Generated by Pinmux utility pin to configure Camera Data and I2C
- camera_app.c Handles DMA Configuration, Camera Capture and NVMEM File operations
- network_if.c Common network interface APIs
- udma_if.c Common uDMA interface APIs
- MT9D111.c MT9D111 sensor related functions are implemented
- startup_*.c Implements tools specific interrupt vector table

WebSocket library is available under '<cc3200-sdk>\netapps\http\server' folder.

usage

- Flash Example Content(html,image,Application binary)on serial flash by following below steps.
 - 1. Open <cc3200-sdk>\examples\camera_application\html\ websocket_application.ucf session file in Uniflash.
 - 2. Flash the files to the device. Detailed instructions at Uniflash User Guide.
- Run the reference application
 - 1. Run From IDE (IAR/CCS)
 - Open the Project as mentioned in the <cc3200-sdk>\docs\CC3200-Getting Started Guide.pdf
 - Build and download the application to the board
- 2. Run Flashed Binary file
 - Remove SOP-2 Jumper on Board and Press Reset. Refer <cc3200-sdk>\docs\CC3200-Getting Started Guide.pdf for detailed Information.
- Device started in AP mode, Connect your PC/SmartPhone to 'mysimplelink-<macAddress>'.
- Open 'mysimplelink.net/camera_demo.html' in browser of PC/MAC/Smartphone, goto 'Camera' tab and Control Camera Capture in the CC3200 device.



- Click on Connect button and wait for a notification pop-up message saying 'WebSocket Connected'.
- After websocket connected click on send button to get the live stream, it may take 10-20 sec for stream to get started on first time.

Limitation/Known Issues

- If downloading html files gives error then try erasing older files from sFlash using Uniflash.
- The camera sensor MT9D111 takes 200 milliseconds to capture every frame. So the maximum throughput is 5 fps. A faster sensor can increase the fps.

Article Sources and Contributors

CC32xx Websock Camera Application Source: http://processors.wiki.ti.com/index.php?oldid=185052 Contributors: Jitgupta

Image Sources, Licenses and Contributors

Image:Configuring_LaunchPad.jpg Source: http://processors.wiki.ti.com/index.php?title=File:Configuring_LaunchPad.jpg License: unknown Contributors: Jitgupta

Image:CC32xx_camera_BP.jpg Source: http://processors.wiki.ti.com/index.php?title=File:CC32xx_camera_BP.jpg License: unknown Contributors: Jitgupta

Image: CC32xx WebSock Camera webpage 1.png Source: http://processors.wiki.ti.com/index.php?title=File: CC32xx WebSock Camera webpage 1.png License: unknown Contributors: Jitgupta

Image:CC32xx WebSock Camera FlowChart.png Source: http://processors.wiki.ti.com/index.php?title=File:CC32xx_WebSock_Camera_FlowChart.png License: unknown Contributors:

Image: CC32xx WebSock Camera Usage webpage.png Source: http://processors.wiki.ti.com/index.php?title=File:CC32xx_WebSock_Camera_Usage_webpage.png License: unknown

License

THE WORK (AS DEFINED BELOW) IS PROVIDED UNDER THE TERMS OF THIS CREATIVE COMMONS PUBLIC LICENSE ("CCPL" OR "LICENSE"). THE WORK IS PROTECTED BY COPYRIGHT AND/OR OTHER APPLICABLE LAW. ANY USE OF THE WORK OTHER THAN AS AUTHORIZED UNDER THIS LICENSE OR COPYRIGHT LAW IS PROHIBITED.

BY EXERCISING ANY RIGHTS TO THE WORK PROVIDED HERE, YOU ACCEPT AND AGREE DE BOUND BY THE TERMS OF THIS LICENSE. TO THE EXTENT THIS LICENSE MAY BE CONSIDERED TO BE A CONTRACT, THE LICENSOR GRANTS YOU THE RIGHTS CONTAINED HERE IN CONSIDERATION OF YOUR ACCEPTANCE OF SUCH TERMS AND CONDITIONS.

1. Definitions

- "Adaptation" means a work based upon the Work, or upon the Work and other pre-existing works, such as a translation, adaptation, derivative work, arrangement of music or other alterations of a literary or artistic work, or phonogram or performance and includes cinematographic adaptations or any other form in which the Work may be recust, transformed, or adapted including in any form recognizably derived from the original, except that a work that constitutes a Collection will not be considered an Adaptation for the purpose of this License.

 "Collection" means a collection of iterary or artistic works, such as encyclopedias and amthologies, or performance or phonograms, or broadcasts, or other works or subject matter other than works listed in Section 1(f) below, Commons of the constitution of the work in the work in the meters, which together are assembled into a collective whole A work that constitutes a Collection will not be considered an Adaptation (as defined below) for the purpose of this License. "Creative Commons as being essentially equivalent to this License, including, at a minimum, because that license: (i) contains terms that have the same purpose, meaning and effect as the License Elements of this License.

 "Distribute" means to make available to the public the original and copies of the Work or Adaptation, as appropriate, through sale or other transfer of ownership.

 "License Elements" means the following high-level license attribut

2. Fair Dealing Rights
Nothing in this License is intended to reduce, limit, or restrict any uses free from copyright or rights arising from limitations or exceptions that are provided for in connection with the copyright protection under copyright law or other

3. License Grant
Subject to the terms and conditions of this License, Licensor hereby grants You a worldwide, royalty-free, non-exclusive, perpetual (for the duration of the applicable copyright) license to exercise the rights in the Work as stated below:

- to Reproduce the Work, to incorporate the Work into one or more Collections, and to Reproduce the Work as incorporated in the Collections; to create and Reproduce Adaptations provided that any such Adaptation, including any translation in any medium, takes reasonable steps to clearly label, demarcate or otherwise identify that changes were made to the original Work. For example, a translation could be marked "The original work was translated from English to Spanish," or a modification could indicate "The original work has been modified."; to Distribute and Publicly Perform the Work including as incorporated in Collections; and, for the avoidance of doubt:

i. Non-waivable Compulsory License Schemes. In those jurisdictions in which the right to collect royalties through any statutory or compulsory licensing scheme cannot be waived, the Licensor reserves the exclusive right to collect such royalties for any exercise by You of the rights granted under this License;
ii. Waivable Compulsory License Schemes. In those jurisdictions in which the right to collect royalties through any statutory or compulsory licensing scheme can be waived, the Licensor waives the exclusive right to collect such royalties for any exercise by You of the rights granted under this License; and,
iii. Voluntary License Schemes. The Licensor waives the right to collect royalties, whether individually or, in the event that the Licensor is a member of a collecting society that administers voluntary licensing schemes, via that society, from any exercise by You of the rights granted under this License.

The above rights may be exercised in all media and formats whether now known or hereafter devised. The above rights include the right to make such modifications as are technically necessary to exercise the rights in other media and formats. Subject to Section 8(f), all rights not expressly granted by Licensor are hereby reserved.

4. RestrictionsThe license granted in Section 3 above is expressly made subject to and limited by the following restrictions:

- license granted in Section 3 above is expressly made subject to and limited by the following restrictions:

 You may Distribute or Publicly Perform the Work only under the terms of this License. You must include a copy of, or the Uniform Resource Identifier (URI) for, this License with every copy of the Work You Distribute or Publicly Perform. Work may not offer or impose any terms on the Work that restrict the terms of this License or the ability of the recipient of the Work You Distribute or Publicly Perform. When You Distribute or Publicly Perform when You may be a public or you must, to the extent practicable, remove from the Collection apart from the Work is required by Section 4(c), as requested. If You create an Adaptation, upon notice from any Licensor Form the Collection apart from the Work is the extent practicable, remove from the Collection apart from the Work is the extent practicable, remove from the Collection apart from the Work is the extent practicable, remove from the Collection apart from the Work is the extent practicable, remove from the Collection apart from the Work is the extent practicable, remove from the Collection apart from the Work is the extent practicable, remove from the Collection apart from the Work is the extent practicable, remove from the Collection apart from the Work is the extent practicable, remove from the Calendary Perform and Adaptation on the work is the extent practicable, remove from the Calendary Perform and Adaptation when the work is the extent practicable, remove from the Work is the extent practicable practicable practicable. The practicable is the practicable is the practicable is the practicable is the p
- To abstrate of the Applicable License. This Section 4(b) applies to the Adaptation as incorporated in a Collection, but this does not require the Collection apart from the Adaptation is self to be made subject to the terms of the Applicable License. This Section 4(b) applies to the hadaptation as incorporated in a Collection, but this does not require the Collection apart from the Adaptation is self to be made subject to the terms of the Applicable License. If you Distribute, or Publicly Perform the Work or any Adaptations or Collections, You must, unless a request has been made pursuant to Section 4(a), keep intact all copyright notices for the Work and provide, reasonable to the medium or means You are utilizing: (i) the name of the Original Author (or pseudonym, if applicable) if supplied, and/or if the Original Author and/or Licensor designate another party or parties (e.g., a sponsor institute, publishing entity, journal) for attribution ("Attribution Parties") in Licensor's copyright notice, terms of service or by other reasonable means, the name of such party or parties; (ii) the tile of the Work if supplied, (iii) to the extent reasonably practicable, the URI. if any, that Licensor specifies to be associated with the Work, unless such URI does not refer to the copyright notice or licensing information for the Work (or in the Adaptation (e.g., Ternch translation of the Work by Original Author," or "Screenpaly based on original Work by Original Author," or Screenpaly based on original Work by Original Author," or Screenpaly based on original Work by Original Author, or Screenpaly based on original Work by Original Author, or Screenpaly based on original Work by Original Author or the avoidance of doubt, You may only use the credit required by this Section for the purpose of attribution in the manner set out above and, by exercising Your rights under this License,

5. Representations, Warranties and Disclaimer

UNLESS OTHERWISE MUTUALLY AGREED TO BY THE PARTIES IN WRITING, LICENSOR OFFERS THE WORK AS IS AND MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND CONCERNING THE WORK, EXPRESS, IMPLIED, STATUTORY OR OTHERWISE, INCLUDING, WITHOUT LIMITATION, WARRANTIES OF TITLE, MERCHANTIBILITY, FITNESS FOR A PARTICULAR PURPOSE,

License

NONINFRINGEMENT, OR THE ABSENCE OF LATENT OR OTHER DEFECTS, ACCURACY, OR THE PRESENCE OF ABSENCE OF ERRORS, WHETHER OR NOT DISCOVERABLE. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OF IMPLIED WARRANTIES, SO SUCH EXCLUSION MAY NOT APPLY TO YOU.

6. Limitation on Liability

EXCEPT TO THE EXTENT REQUIRED BY APPLICABLE LAW, IN NO EVENT WILL LICENSOR BE LIABLE TO YOU ON ANY LEGAL THEORY FOR ANY SPECIAL, INCIDENTAL, CONSEQUENTIAL, PUNITIVE
OR EXEMPLARY DAMAGES ARISING OUT OF THIS LICENSE OR THE USE OF THE WORK, EVEN IF LICENSOR HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

7. Termination

- This License and the rights granted hereunder will terminate automatically upon any breach by You of the terms of this License. Individuals or entities who have received Adaptations or Collections from You under this License, however, will not have their licenses terminated provided such individuals or entities remain in full compliance with those licenses. Sections 1, 2, 5, 6, 7, and 8 will survive any termination of this License. Subject to the above terms and conditions, the license granted here is perpetual (for the duration of the applicable copyright in the Work). Notwithstanding the above, Licensor reserves the right to release the Work under different license terms or to stop distributing the Work at any time; provided, however that any such election will not serve to withdraw this License (or any other license that has been, or is required to be, granted under the terms of this License, and this License will continue in full force and effect unless terminated as stated above.

- Each time You Distribute or Publicly Perform the Work or a Collection, the Licensor offers to the recipient a license to the Work on the same terms and conditions as the license granted to You under this License. Each time You Distribute or Publicly Perform an Adaptation, Licensor offers to the recipient a license to the original Work on the same terms and conditions as the license granted to You under this License. If any provision of this License is invalid or unenforceable under applicable law, it shall not affect the validity or enforceability of the remainder of the terms of this License, and without further action by the parties to this agreement, such provision shall be reformed to the minimum extent necessary to make such provision shall be reformed to the minimum extent necessary to make such provision shall be reformed to the minimum extent necessary to make such provision of this License shall be deemed waived and no breach consented to unless such waiver or consents that the entire agreement between the parties with respect to the Work its entire under the provision of this License shall be deemed twaived and no breach consented to unless such waiver or consents that the entire agreement between the parties with respect to the Work its entire under the provisions that may appear in any communication from You. This License may not be modified without the mutual written agreement of the Licenser and You.

 The rights granted under, and the subject matter referenced, in this License were drafted utilizing the terminology of the Bernee Convention for the Protection of Literary and Artistic Works (as amended on September 28, 1979), the Rome Convention of 1961, the WIPO Copyright Treaty of 1996, the WIPO Performances and Phonograms Treaty of 1996 and the Universal Copyright Convention (as revised on July 24, 1971). These rights and subject matter take effect in the relevant jurisdiction in which the License terms are sought to be enforced according to the corresponding provisions of the implementation of t