Bluetooth Based TV tuner for

Portable Devices

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Abstract – This is a bluetooth based TV tuner for use with a portable devices equiped with bluettoh interfaces. Examples are PDA phone or JAVA capable phone. The bluetooth TV tuner is suitable to be fixed at a premise or vehicle (train, bus, cab) and acts as a bluetooth master. A slave device (the PDA phone) connects to the TV tuner and tune into a desired channel. TV video is than channelled through bluetooth to the portable device. With this bluetooth TV tuner, every phone user can watch TV on their phone wherever they are, provided that location is equiped with a bluetooth TV tuner

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Contents

Introduction

**Fig.1** The actual hardware and its application

As shown in Fig.1, this is a bluetooth based TV video tuner for used with portable device such as a PDA phone. With this tuner, any phone user with a bluetooth phone can access the tuner and tune in to watch TV program on their device. The bluetooth TV tuner board is to be fixed at premises such as buildings or moving vehicles such as bus and train, and the phone user in it can, as such, watch TV at any time, as long as they have a bluetooth phone. The bluetooth TV tuner consists of a MSP430F169, which is on an Olimex's prototype board as seen in Fig.1. The actual tv tuner and bluetooth devices are located on a daughterboard (also can be seen in Fig. 1). A portable antenna is shown connected to the daughterboard in Fig. 1. The bluetooth tv tuner can run off battery or connected to a car power supply point (12V).

Functional Subsystem and Components

Main specification of the Biosignal Monitoring Transmit system prototype.

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Microcontroller	MSP430F169
Video Decoder	Texas Instruments TVP5150
TV tuner	Philips TV tuner FOD1216
Bluetooth wireless communication	KC Wirefree KC21 bluetooth 1.2
Power	Input: DC 7V-12V
	(devices on board running on 1.8V, 3.3V and 5V)
Physical Size (W x H)	Olimex MSP430P169 board – 9cm x 7cm
	Bluetooth TV tuner board – 11cm x 11.5cm

Block Diagram
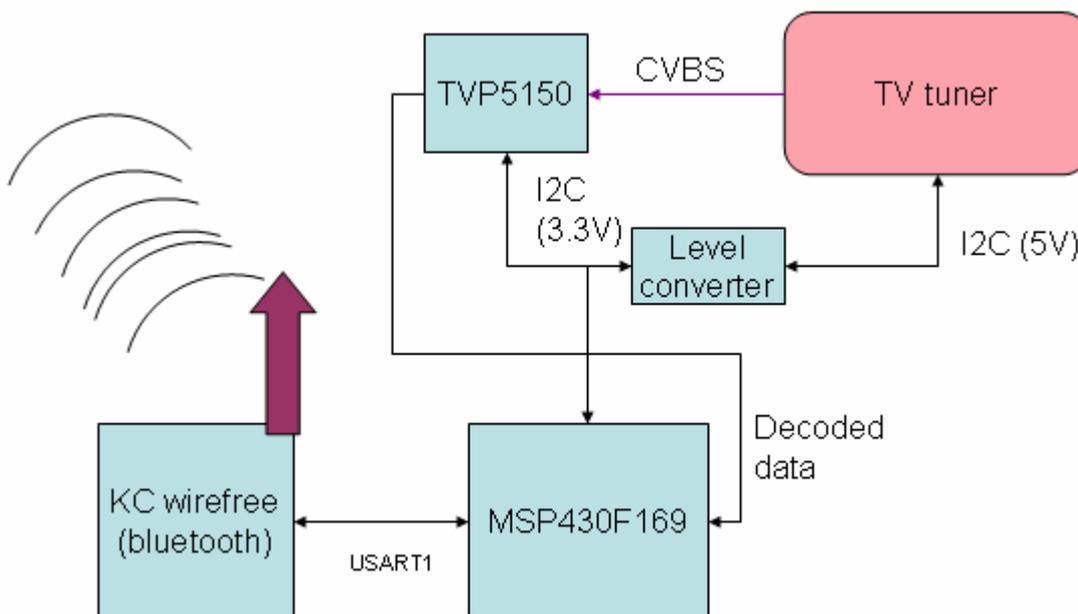
Fig. 2 Block diagram showing different devices in the system

The core of the system controller is the MSP430F169 microcontroller. This controller controls all the other devices and presents the decoded TV video to the portable device user over bluetooth. I2C is used to control the video decoder IC from Texas Instruments, TVP5150. This chip is capable of decoding various TV format, in this case PAL (which is used in my country), and presents it as ITU-R Bt.601 digitial video stream. The TV tuner module is by Philips, model

FOD1216. It is actually a hybrid analogue TV tuner and digitial terrestrial TV tuner, however, in this work, only the analogue portion is been utilized. It is also be controlled via I2C bus from the MSP430F169. A level translator from Maxim, max3373 is used to link between the 5V I2C bus of FOI1216, to that of the 3.3V I2C bus of TVP5150 and MSP430F169. The microcontroller fetches the decoded video to a bluetooth module by KC wirefree, a KC21, through USART1 serial link. This is a bluetooth version 1.2 transceiver.
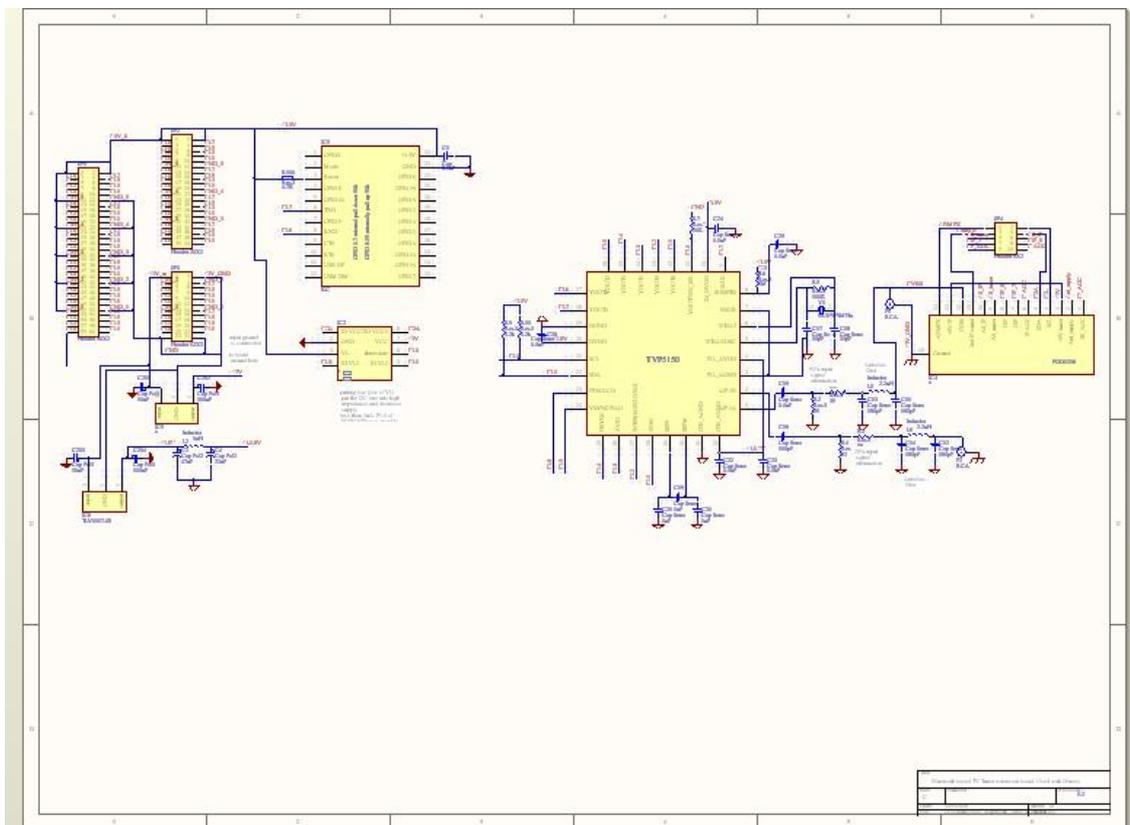
Hardware Design

In this section, detailed description of the hardware is presented. Fig 3 and Fig 4 shows the entire hardware schematic used in this works. Details of the subsystem is explained later on.
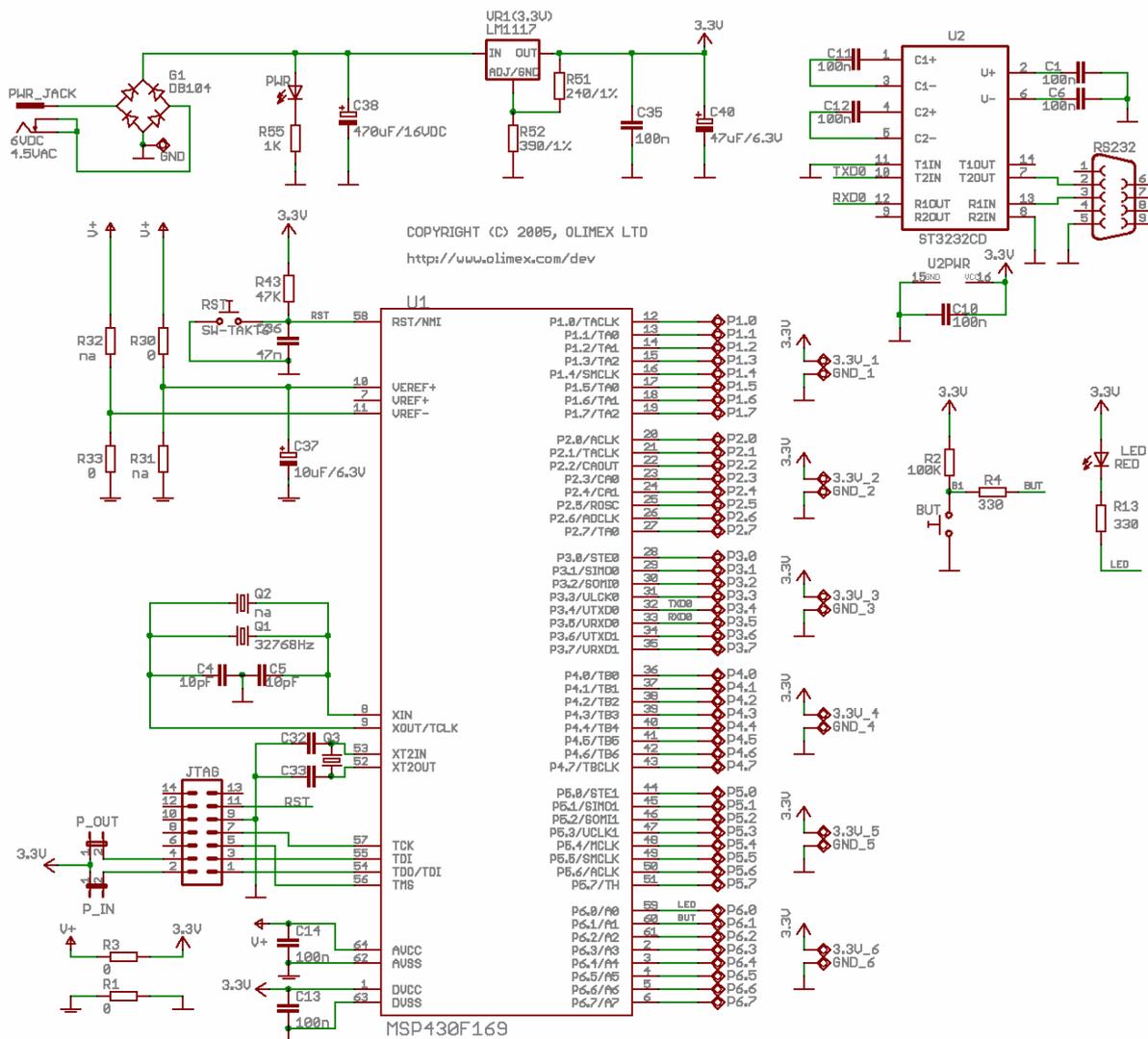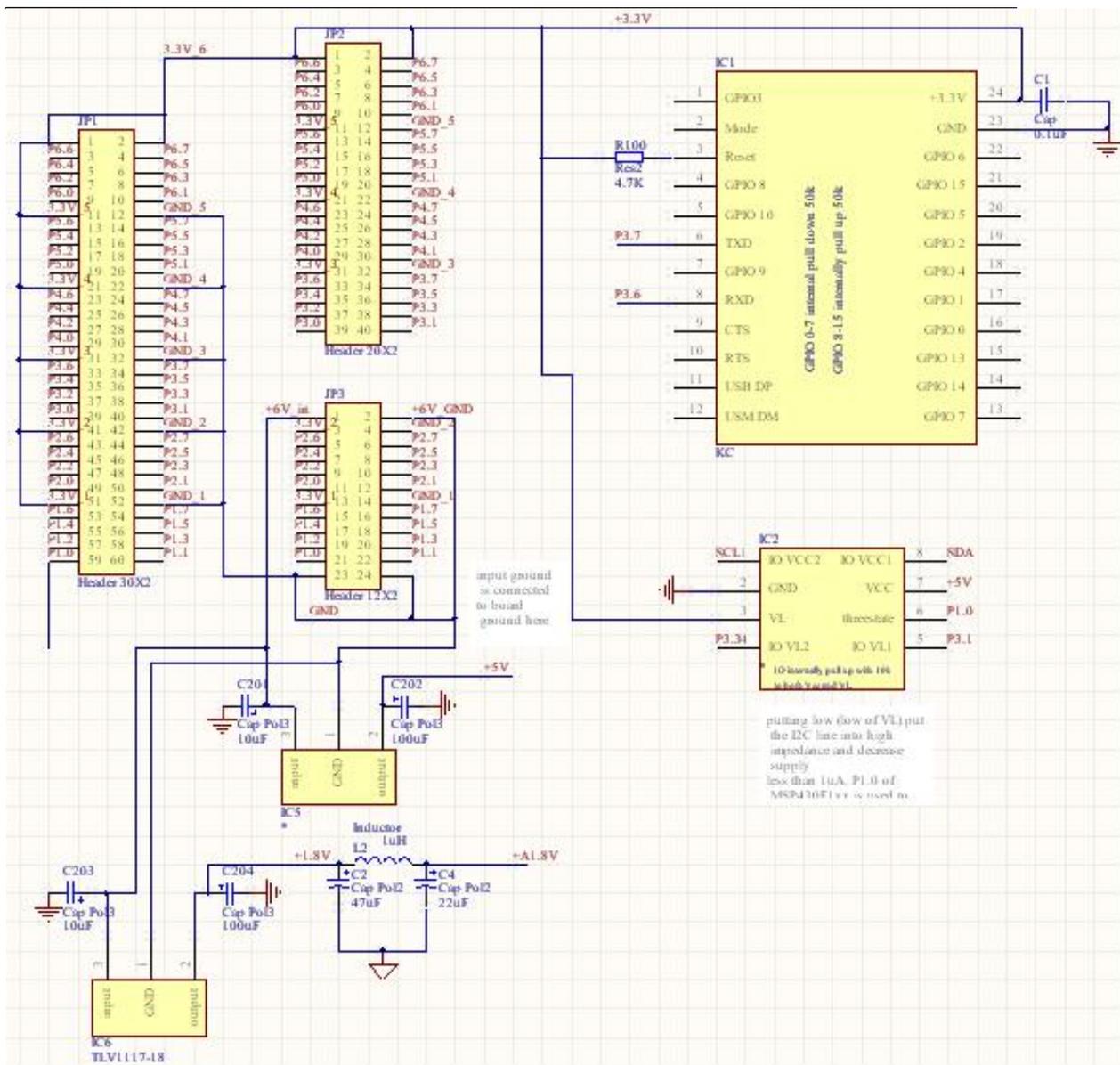

Fig. 3 Eval kit from Olimex for MSP430F169

This source image file can be obtained from http://www.olimex.com/dev/images/msp430-pxxx-sch.gif

Fig. 4 Daughtercard of the bluetooth tv tuner. Clearer pictures, section by section, follows later

5

Fig. 5 The connections to the MSP430 board and KC21 bluetooth module

The MSP430F169

The MSP430F169 is located on the prototype board by Olimex, as shown in Fig. 3. MSP430F169 is ultra low-power mixed signal microcontrollers with a lot of functionalities. What is important is that MSP430F169 contains sufficient customizable data port for a complete embedded system. The microcontroller is set to have a USART0 for communication with the bluetooth module, I2C for video tuner module and the video decoder, some I/O for controlling different function of the board (for example /PDN on MSP430F169 for power saving feature). The evalution board MSP430-P169 from OLIMEX is used for this purpose.

Power Supply

Devices on board are running at multiple voltages, such as 1.8V, 3.3V and 5V. 3.3V power supply is taped from the OLIMEX evaluation board, which makes use of a LM1117. 1.8V and 5V is supplied by TLV1117 chips on the extension board. The circuit below is self explainatory.
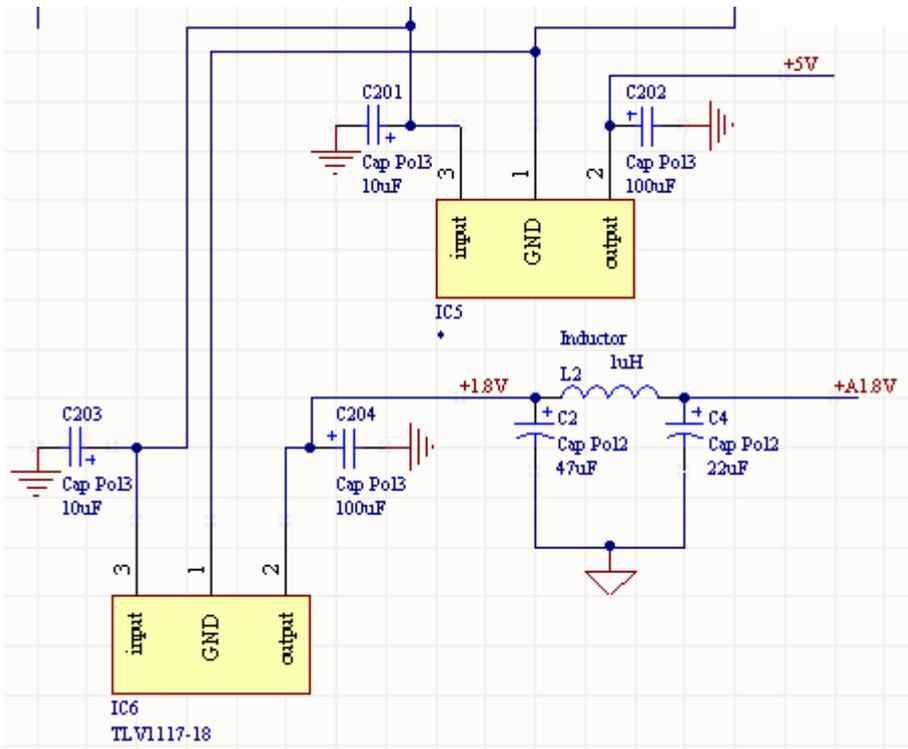
Fig. 6 Power supply for 1.8V and 5V. 3.3V supply is located on the MSP430F169 board

TV Tuner and Video Decoding

Philips FOD1216 is able to tune into a PAL video (used in Malaysia) through I2C control. The analogue video is fed into the TVP5150 video decoder, whereby it is coded into ITU-R BT.601 digital video.
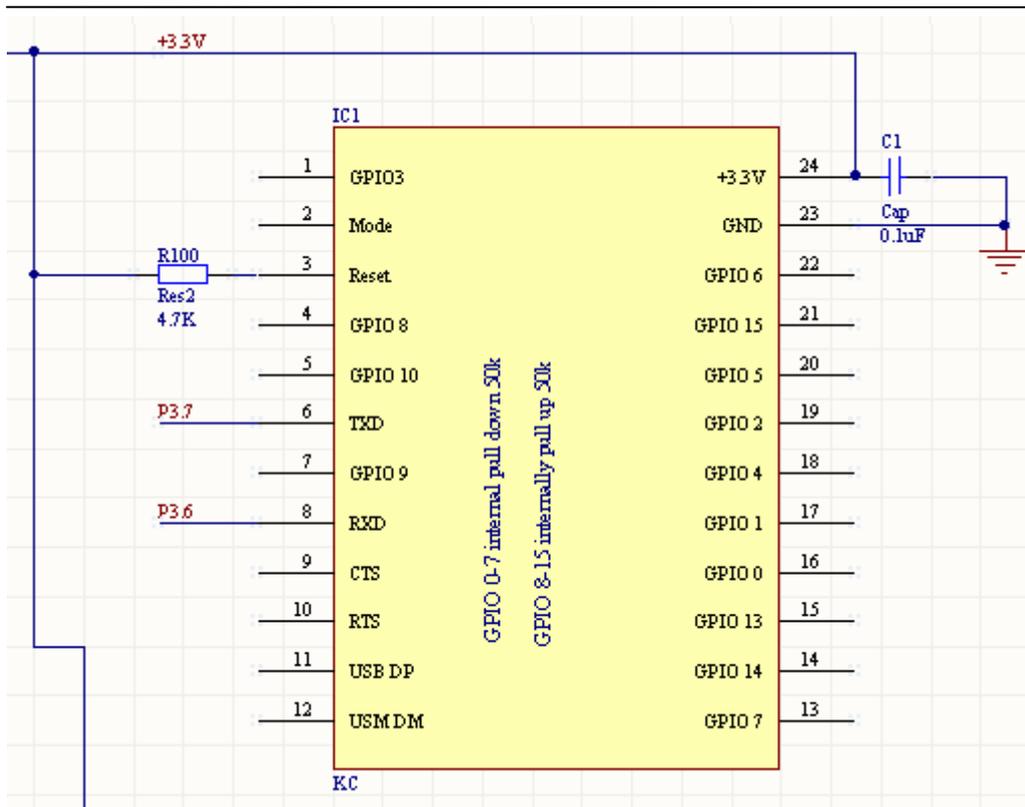
Fig. 7. TV tuner FOD1216 and TVP5150

Bluetooth Interface & Serial Communication

KC21 from KC Wirefree (http://www.kcwirefree.com) is used for transmitting decoded ITU-R Bt.601 digital video to the targeted portable devices. KC21 requires relatively few connections. Only TXD/RXD lines need to be connected between KC21 and the MSP430F169 USART1. KC21 is a bluetooth 1.2 devices so it doesn't offer the best speed availbe in the current bluetooth marekt.

Fig. 8 The KC21 and serial link to the MSP430F169 USART1 (P3.6 and P3.7)

I2C communication

The TVP5150 and FOD1216 needs to be control via I2C. MSP430F169 has a dedicated I2C for this purpose. Acting as master I2C device, the MSP430 set the necessary information needed by the TVP5150 and FOD1216. Due to the fact that TVP5150 is running on 3.3V for its IO, whereas FOD1216 is a pure 5V device, a level translator is used between the two. Max3373 from Maxim serves this purpose. The translator can be put into high impedance state, and as such the I2C bus, by the microcontroller during power down stage to conserve power.
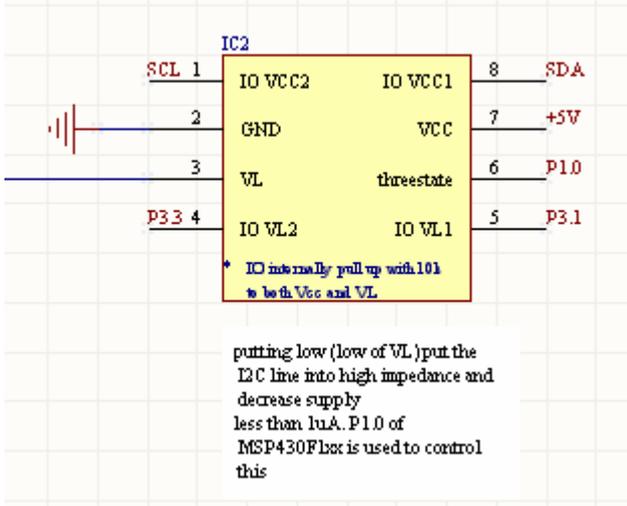
Fig. 9 The level translator chip MAX3373

Fig 10 and Fig 11 shows the photo capture of the actual daughtercard. In Fig. 10, The wires connecting the daughtercard to the MSP430F169 prototype board is seen on the right hand side of the figure. In Fig. 11, as can be seen in the top left hand side corner, the board can actually accepts analogue video source such as from a CCTV camera, but its functionality is not discussed in this document.
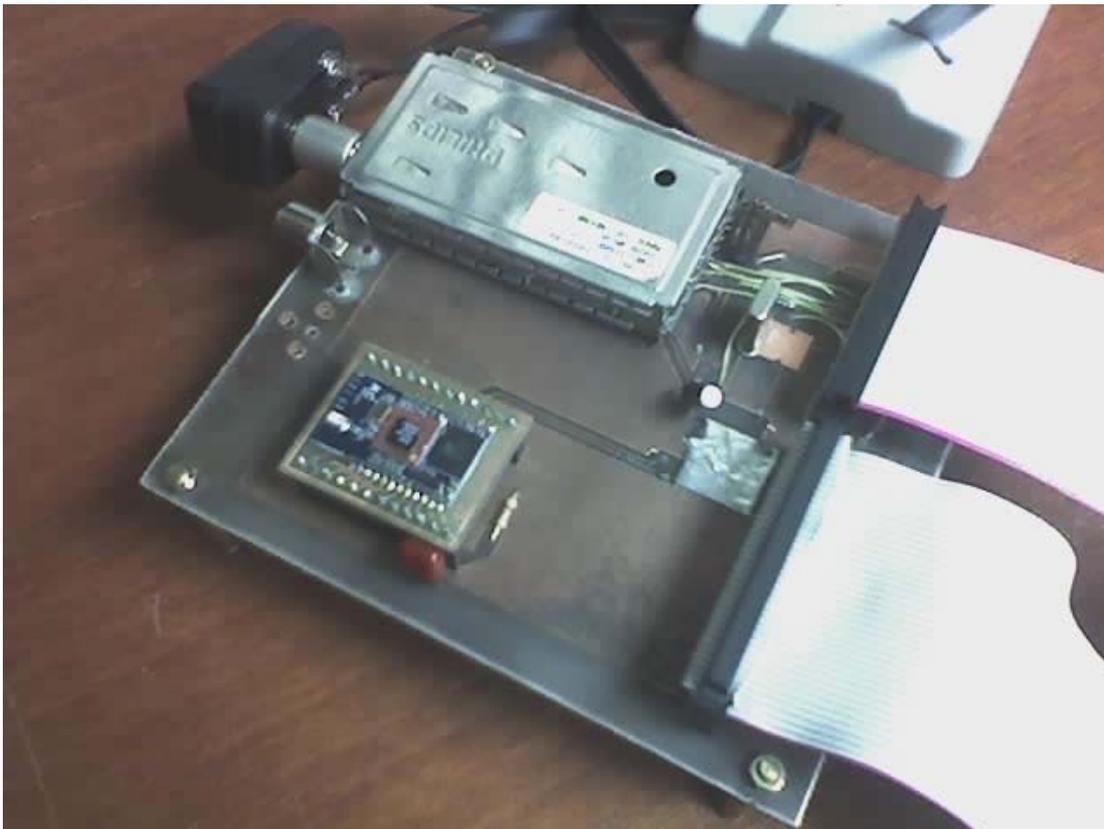
Fig 10. The bluetooth TV tuner daughtercard, showing the bluetooth module and TV tuner FOD1216, and the connection to antenna.
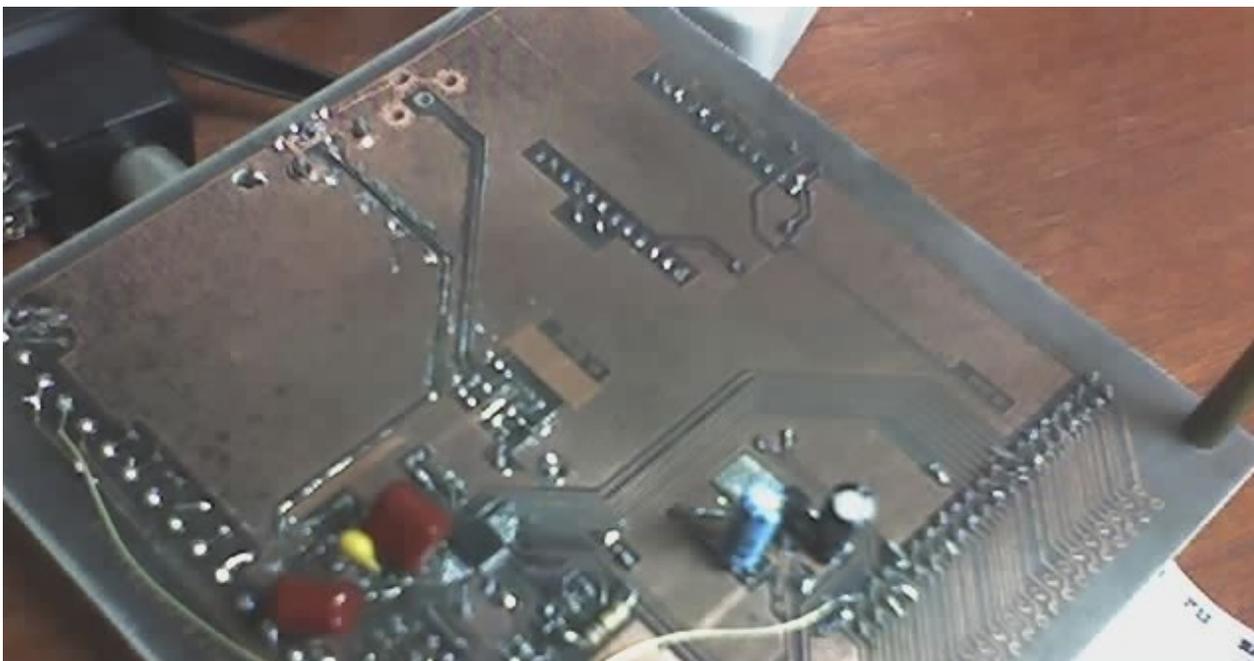
Fig 11. The backside of the TV tuner daughtercard showing all the SMT devices and some thru hole electrolytic capacitors. The TVP5150 can be seen situated next to some capacitors

11

Future Improvement

- Use of FIFO memory for buffering of decoded video will improve performance
- Use of Bluetooth version 2 for faster speed. Currently is using Bluetooth version 1.2

References

1. MSP430x1xx Family User's Guide

2. KC Wirefree KC21 datasheet on http:// www.kcwirefree.com

3. TVP5150 Datasheet

4. Philips TV tuner FOD1216

5. ITU-R BT.601 video format information on http://www.wikipedia.org