Wireless Level

ECE 445

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Introduction

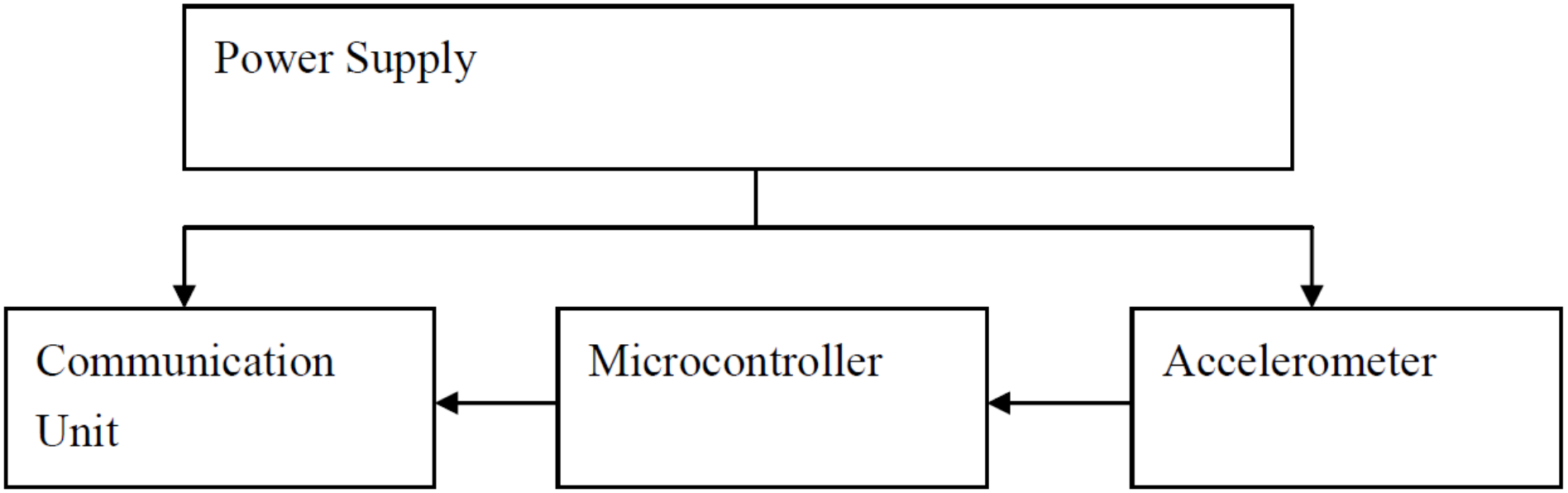
- There exists a need on the market for a low-cost, low-power-consumption, tri-axis, and yet accurate wireless level device.

- A wireless level device could be important in construction industries.

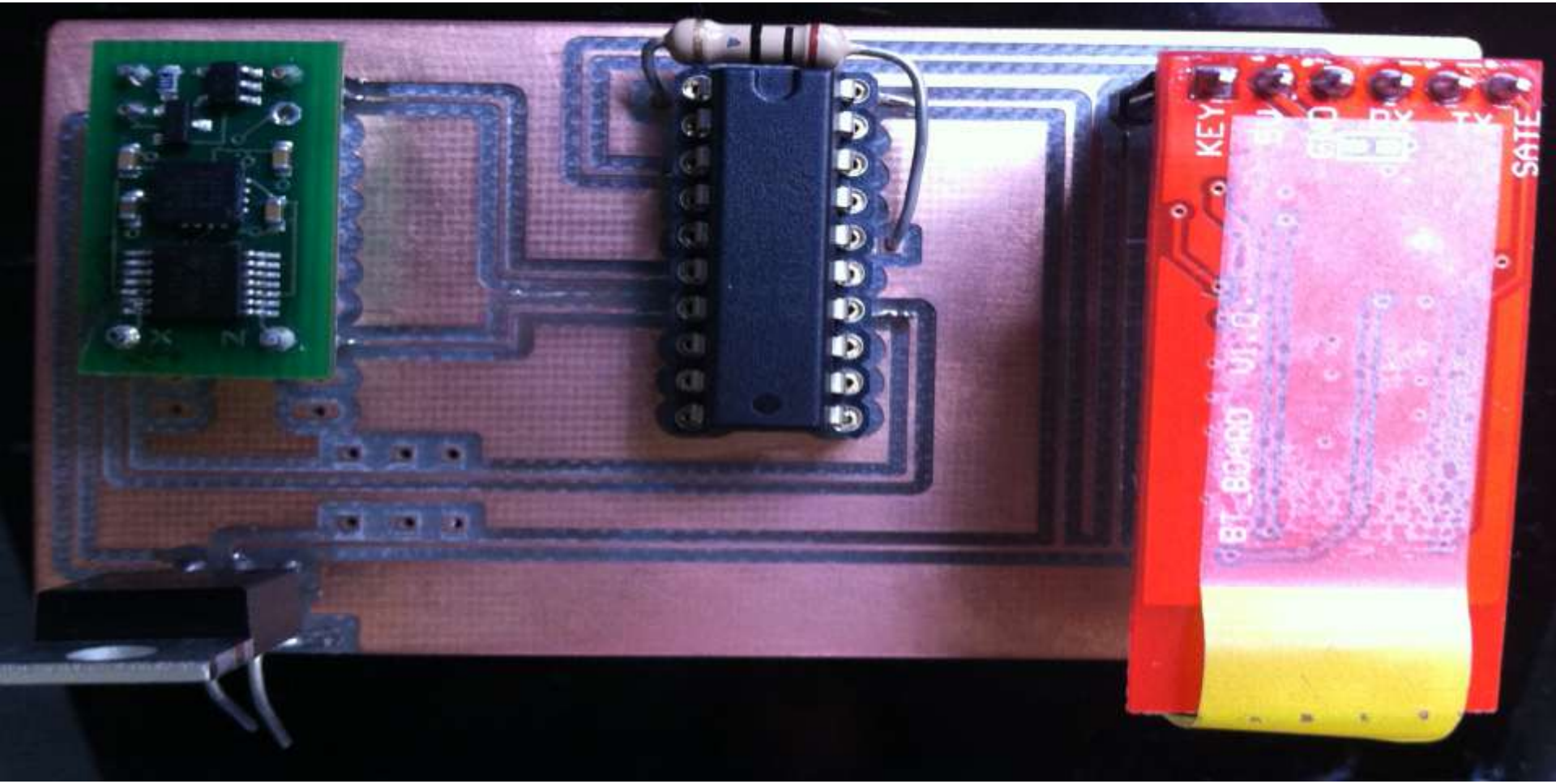
Objectives

- Provide accurate tri-axis tilt level.
- Handheld device that will allow distant monitor of the level.
- Suitable for common work environments.

Level Module



Level Module PCB



Tests for Level Module

- Accelerometer (DE-ACCM3D)

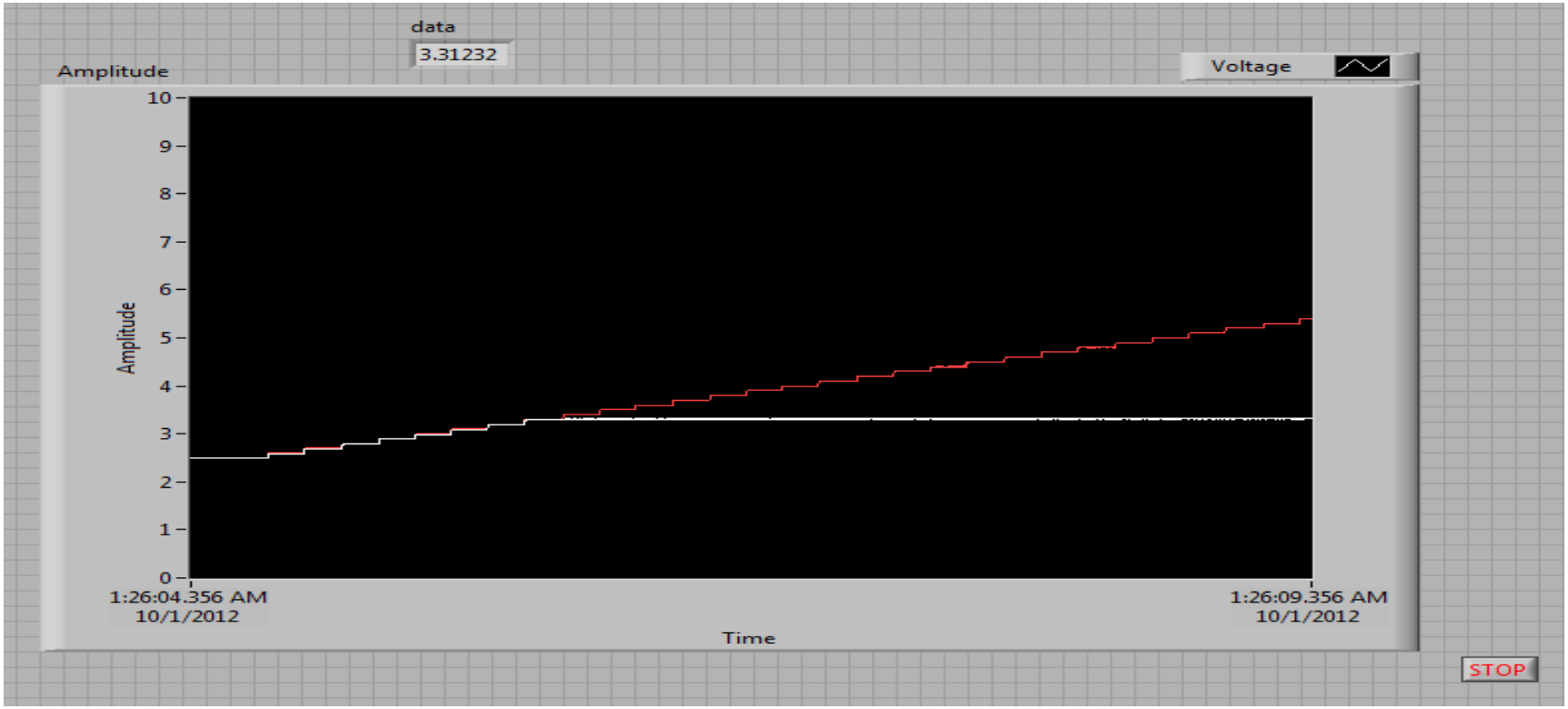
- Accelerometer to MSP430

Accelerometer (Requirements)

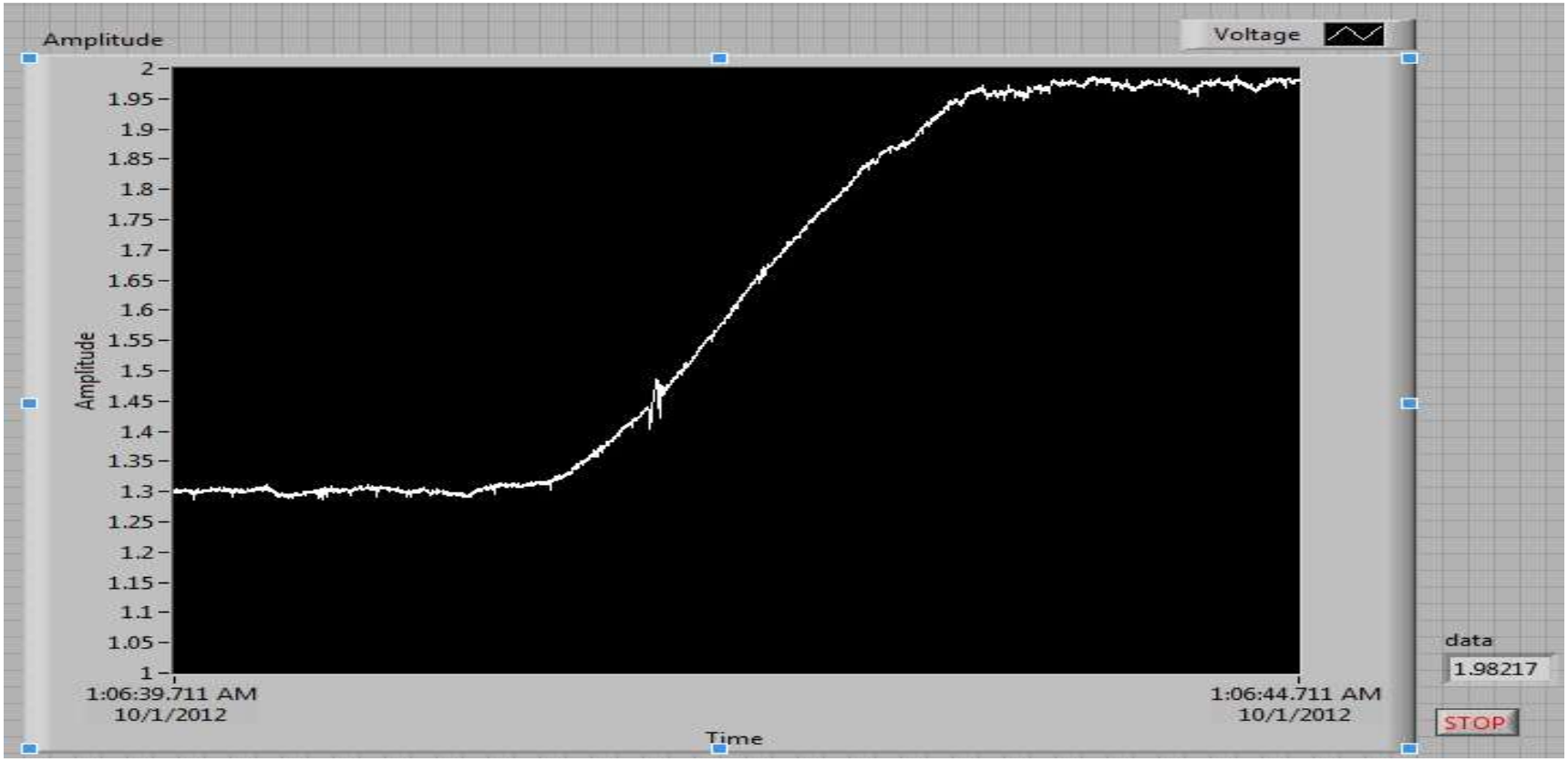
- Verify that the reference voltage is stable at 3.3 V.

- Verify that the measured output voltage matches the accelerometer tilt angle.

Accelerometer (Verification)



Accelerometer (Verification)



Accelerometer to MSP430 (Requirements)

- Verify if the input analog signals are successfully converted to digital data.
- Verify if the digital data is successfully converted to tilt angles.

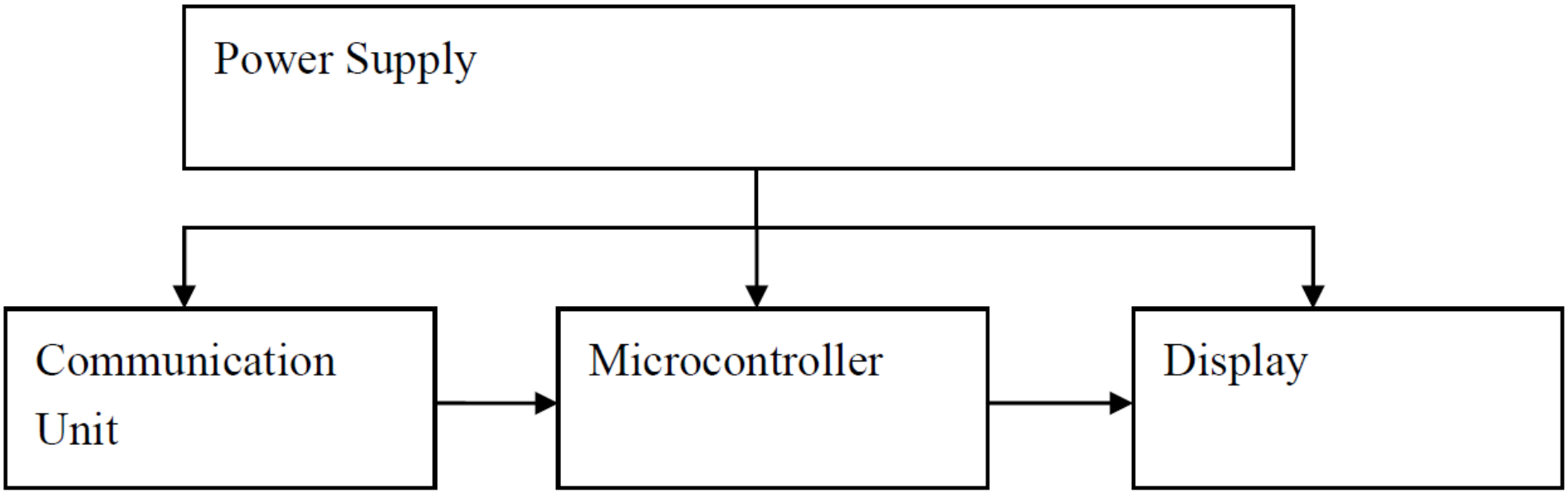
Accelerometer to MSP430 (verification)

- ADC10
- Angle= $\sin^{-1}[(Vx,y,z - V_0)/ \text{sensitivity}]$

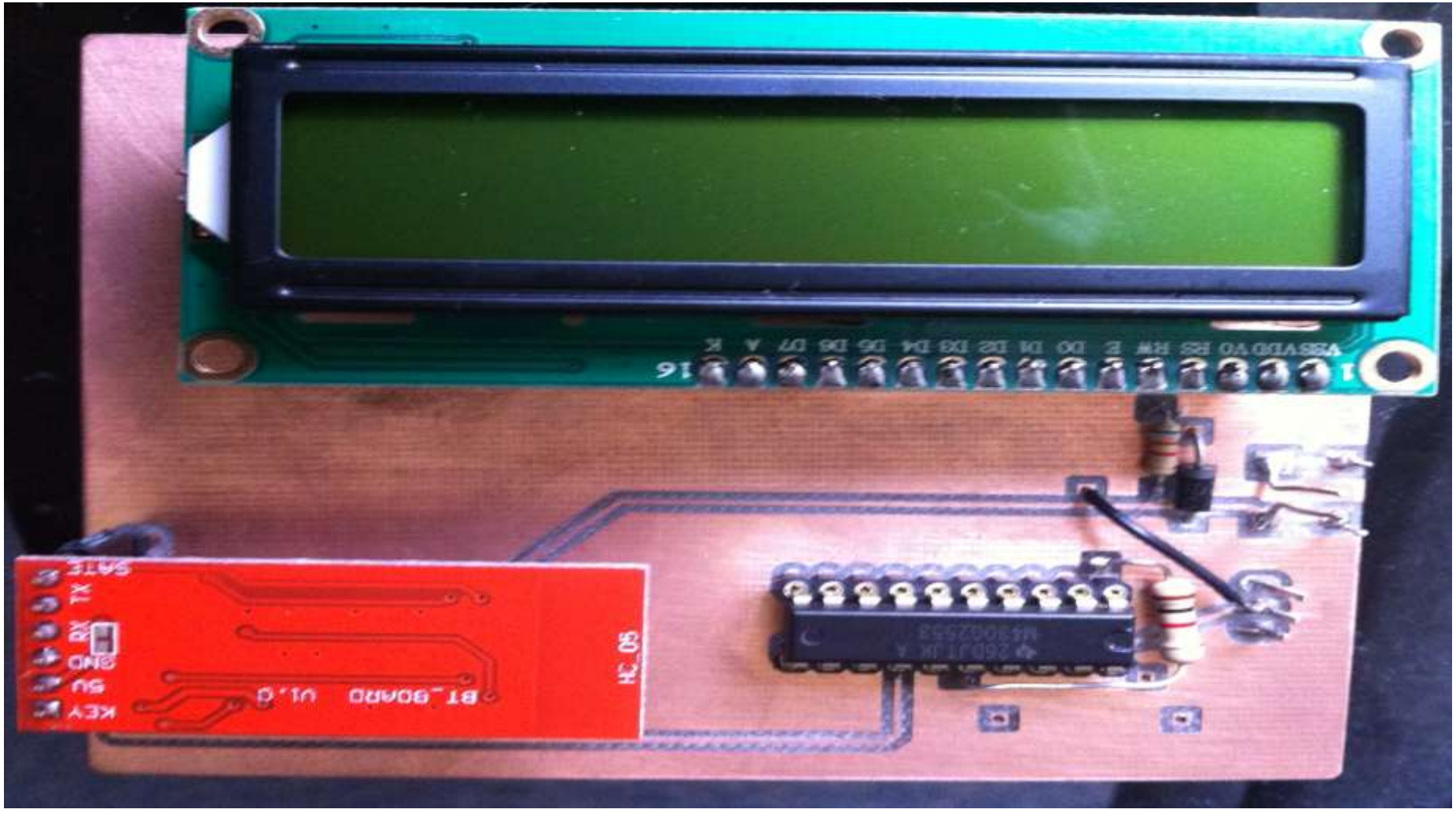
Accelerometer to MSP430 (Verification)

LED	1	2	3	4	5
Digital Data	819~ 1023	614~ 818	409~ 613	204~ 408	0~ 203
Angle	+54~ +90	+18~ +53	-18~ +17	-54~ -19	-90~ -55

Receiver Module



Receiver Module PCB



Tests for Receiver Module

- MSP430- LCD display
- Transmission of data between the two modules.

LCD

- Requirements: Make sure the LCD could display a cursor.
- Verification: Manually control the input bits and follow the steps provided by the data sheet.

MSP430-LCD (Requirements)

- Display “hello world!” on the LCD.
- Display “X=__, Y=__, Z=__, T=__”.

MSP430-LCD (Verification)

- Program the MSP430 such that it stores the digital data in the registers and see whether it can convert the digital data into tilt angles and outputted to the LCD. We will check whether the angle is correct by using the formula sheet provided by the accelerometer package.

Transmission of Data by Bluetooth (Requirements)

- Make sure the bluetooth on each module can communicate.
- Make sure that the level data is correctly sent to the receiver module.
- Make sure that the distance of communication is above 15 meters.

Transmission of Data by Bluetooth (Verifications)

- Check with oscilloscope to see whether input and output matches.
- Display the actual tilt level on the LCD.
- Move around an empty space and observe the distance of communication.

Power Supply Test Results

	Level Module	Receiver Module
Current (mA)	25	36
Battery Life Time (hours)	100	70

Failures

- Wireless Communication (XBee)
- Tilt angle (ADC)