

# A Smart Energy Monitoring System

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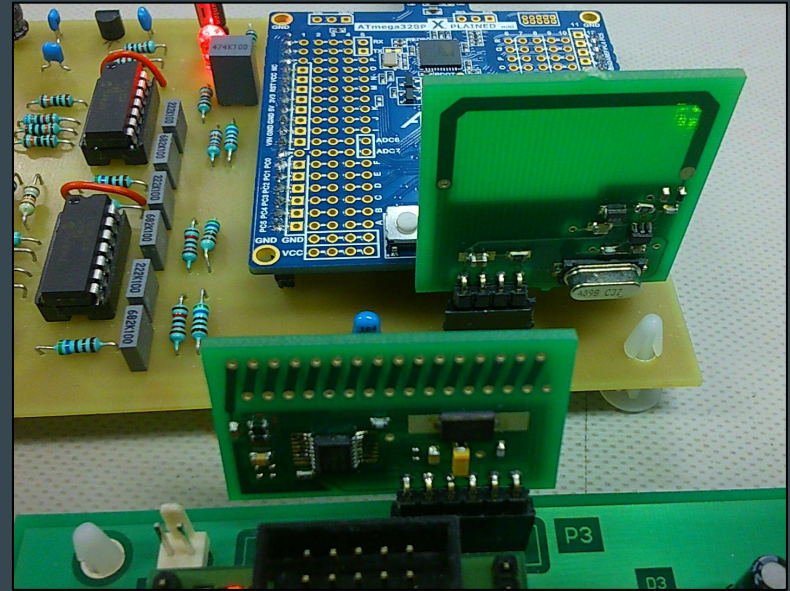
ELECTENG 209 GROUP 37

# Introduction

- To develop smart energy monitoring system for Tru-Test
- To measure and display the energy consumed by household appliances.
- Makes checking current energy consumption convenient and easy
- One part of the system measures average power, peak current, rms voltage
- Another part of the system displays these data values and uploads to an online database
- Final part of the system is an android app which will be able to display real time data using the online database

# Features and Specifications

- Working Voltage Range: 110-240 V<sub>rms</sub> <sup>[1]</sup>
- Load Source Frequency: 50 Hz
- Measurement accuracy:  $\pm 2\%$
- Battery or wall powered: Wall powered
- Maximum Load: 3450 VA <sup>[2]</sup>
- Display: LCD Screen
- Measurements displayed:  $I_{pk}$ ,  $V_{rms}$ , and Average Power
- Aesthetics: Wall socket mounted container
- Size: 10cm x 6cm x 4cm (wall mounted device), 10cm x 8cm x 8cm (display)
- Connectivity - Radio Frequency UART



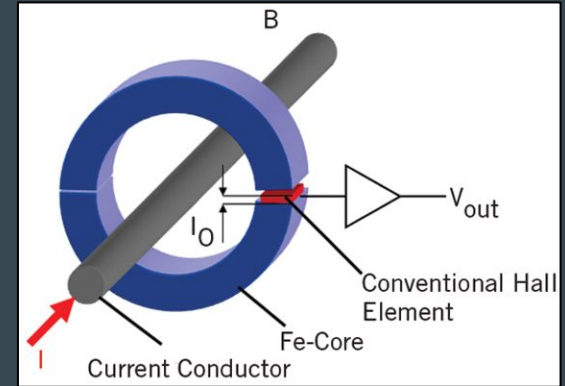
# Comparison to Kill-A-Watt [3,4]

- Kill-A-Watt has measurement accuracy of ( $\pm 0.2\%$ ), ours has accuracy of ( $\pm 2\%$ )
- Kill-A-Watt has a lower maximum load (1875 VA) than our product (3450 VA)
- Kill-A-Watt has max load voltage of (115 Vrms), ours can go upto
- Kill-A-Watt uses an LCD display, our solution also uses LCD display
- Our solution has greater connectivity - data accessible via Android App

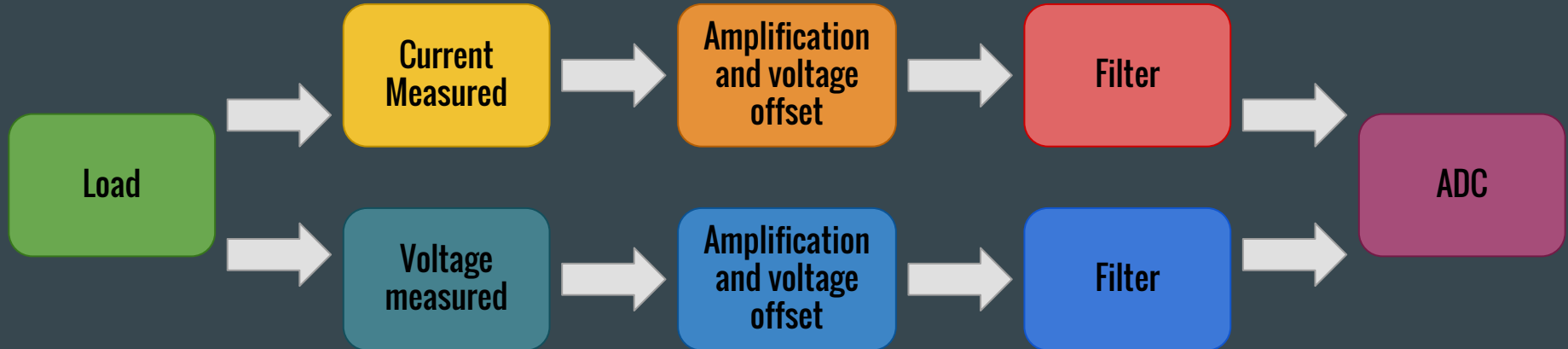


# Solution - Analogue

- Voltage measuring
- Current measured using Hall-Effect Sensor
- Amplification and Voltage Offset
- Filtering



[5]



# Solution - Digital

- ATmega328p reads voltages via ADC
- Calculation of  $V_{rms}$ ,  $I_{pk}$ , and Average Power
- Transmission to ATmel Xplained Pro via UART and RF modules
- ATmel Xplained Pro displays values on an LCD Display



# Solution - Android App

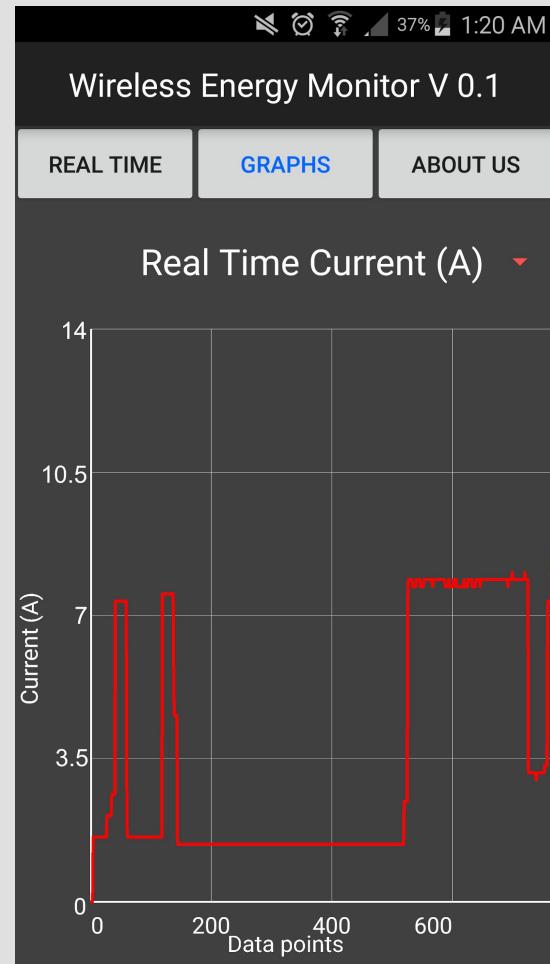
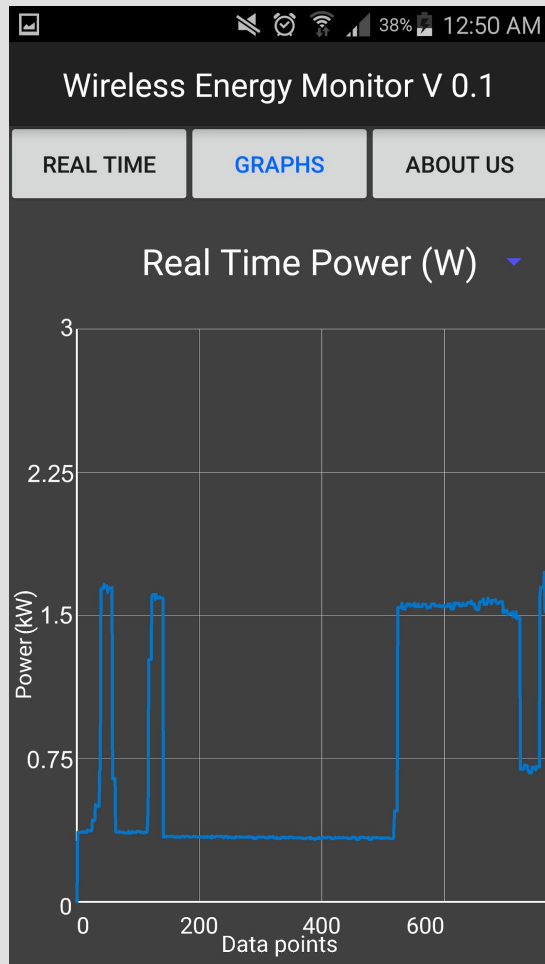
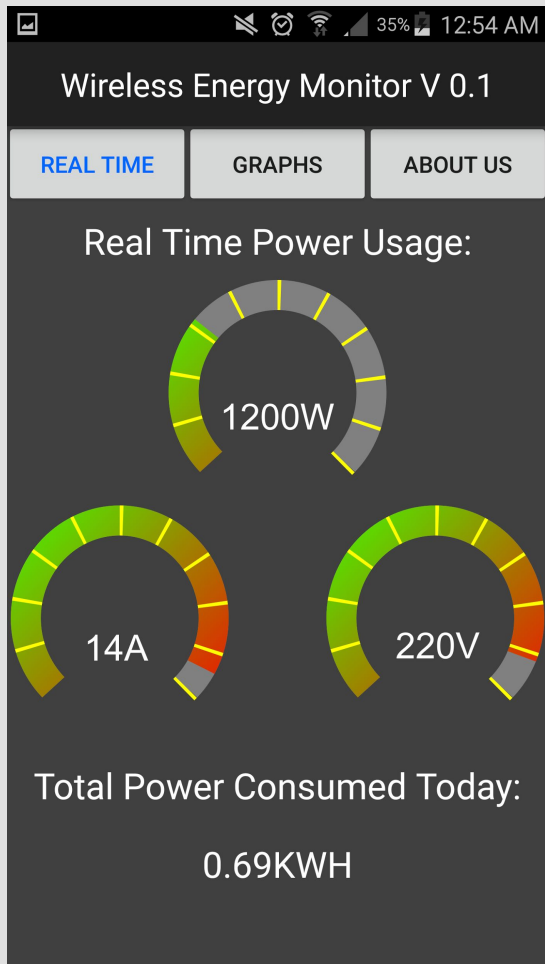
- ATmel Xplained Mini
  - Displays data on LCD screen via SLCD1 Xplained Pro extension board
  - Uploads to Firebase via Ethernet1 Xplained Pro extension board
- Firebase
  - Data stored in dictionary format
  - Randomised key and JSON value
- Android App
  - Real time graphing
  - Smart Monitoring



[6]



[7,8]





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# Radio Frequency Standards <sup>[9]</sup>

- (SRD) Short range devices must meet AS/NZS 4268 EN 300 220, CISPR 11
- No harmful interference to other radiocommunications devices.
- ISM (Industrial, scientific and medical) radio bands interference
- Power levels for 25 MHz - 1000 MHz up to 500mW (subrange dependant)
- LIPD (Low interference potential devices) class licensing

# Radio Frequency Standards - Project Specific

- Meets AS/NZS 4268, EN 300 220, CISPR 11
- Minimize interference with household appliances (microwave oven 2.45 Ghz)
- Use of MICRF113 and MICRF220[10]
- Below maximum output power levels at 10 dBm (10mW). Max (14dBm)[11]



[12]

# References

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