IJMTST | Volume: 2 | Issue: 03 | March 2016 | ISSN: 2455-3778

Design Efficient Wireless Monitoring Platform for Recycling Point Spots

G.Karthik Prabhu[1] | S.Sri Jamiya[2] | R.Venkatesh[3] | V.Senthil Kumar[4]

[1,2]PG Scholar, Department of Electronics and Communication Engineering, Vel Tech Multi Tech Dr.Rangarajan Dr.Sakunthala Engineering College, Chennai, TamilNadu, India
[3]PG Scholar, Department of Electronics and Communication Engineering, Bharath University, Chennai, TamilNadu, India.
[4]Assistant Professor, Department of Electronics and Communication Engineering, Vel Tech Multi Tech Dr.Rangarajan Dr.Sakunthala Engineering College, Chennai, TamilNadu, India

ABSTRACT

There is a growing demand for low cost, very low power and reduced size monitoring systems with wireless communications, to be used in different kinds of industrial environments. In several countries waste separation and recycling is a major issue. Consequently, the number of recycling spots has been steadily increasing. In order to ensure that recycle bins are properly maintained, several monitoring solutions have been proposed. These still have several limitations, such as requiring wires for power and/or communications and not being able to fit in all existing types of bins. This paper presents WECO, a wireless embedded solution for monitoring the level of the bins located in recycling spots. The proposed system automatically alerts a remote central station when a bin reaches a programmable filling level, thus avoiding the need to spot check if the bin is full and ensuring that the recycling spot is kept clean. The developed prototype required hardware-software co-design and aimed to meet the above mentioned requirements, resorting to the IEEE 802.15.4 protocol for wireless communications between all nodes in the network, each based on a System-On-Chip CC2530 from Texas Instruments. Due to its wireless nature, the architecture requires a battery for power supplying the nodes, with a life time of at least six years. The filling level readings of each bin in a recycling spot are made using an ultrasonic sensor. The data collected by the monitoring platform is then sent to the remote central station that processes it in order to optimize routes and establish a scheduled collection of the recycling spots.

KEYWORDS: *WECO, Ultrasonic Sensor, LED, Microcontroller, GSM*

I. INTRODUCTION

Nowadays, people have become more concerned about the environment and begin to increasingly separate their waste. The waste is separated at home and later deposited in outdoor recycling bins located at a recycling spot. When recycling bins are full, collecting vehicles, owned by public or private companies, continuously collect such waste thus providing a useful service for the population and the environment. Ideally, after bins are full, the waste should be collected in a short period of time and periodically. In reality, without a monitoring system of the recycling bins filling level, the collecting authority has difficulties in optimizing routes for the collecting vehicles. Without a monitoring system, waste collection sometimes fails, resulting in collecting an empty recycling bin, one with a very-low fill level, or even one that was full a long time ago (generally meaning that the area around the bin is full of dumped waste). This leads to a waste of time and fuel, which is reflected in losses for the managing companies, since their source of revenue comes from the amount of collected waste destined for recycling. In this context, and aiming to increase

the efficiency of the waste collection, this paper suggests WECO, a remote and self-sufficient, from an energetic point of view, monitoring platform for the recycling point spot. The use of cables limits the existing system employability in any kind of recycling bin, because for outdoor recycling bins, during the collection process, the whole container is picked with a crane and all wires would break, causing the system to fail.

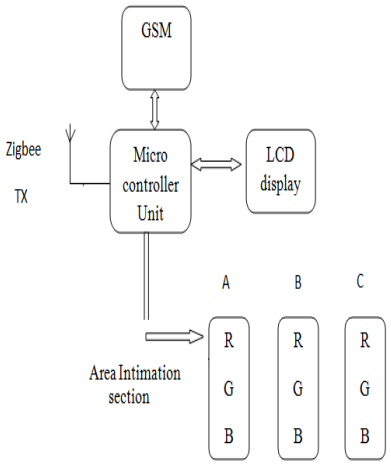


Fig 1.1: System Architecture

II. Circuit Operation

A. PIR Sensors

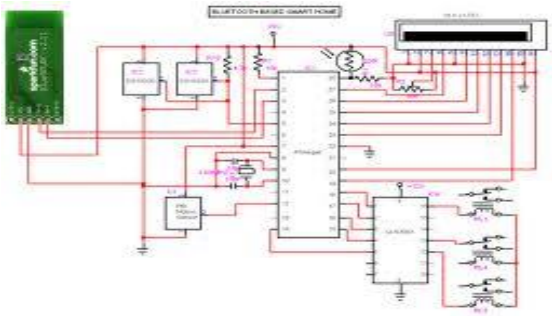


Fig 2.1: PIR sensor using Atmel 328 microcontroller

PIR sensors allow you to sense motion, almost always used to detect whether a human has moved in or out of the sensors range. They are small, inexpensive, low-power, easy to use and don't wear out. For that reason they are commonly found in appliances and gadgets used in homes or businesses. They are often referred to as PIR, "Passive Infrared", "Pyro electric", or "IR motion" sensors. The hardware is powered by a 5V source preferably with a 5V regulator like 935. If solar panels and batteries are used then a 12V source will also be needed to power purpose. The AVR micro's AVREF and AVCC pins should be both connected to the 5V source. The distance between the LM35 sensor and the AVRs ADC pin must not be greater than 10-12cm for proper temperature reading. The LM317 is an adjustable 3−terminal positive voltage regulator. Capable of supplying in excess of 1.5 A over an output voltage range of 1.2 V to 37 V. This voltage regulator is exceptionally easy to use and requires only two external resistors to set the output voltage. Further, it employs internal current limiting, thermal shutdown and safe area Compensation, making it essentially blow−out proof.

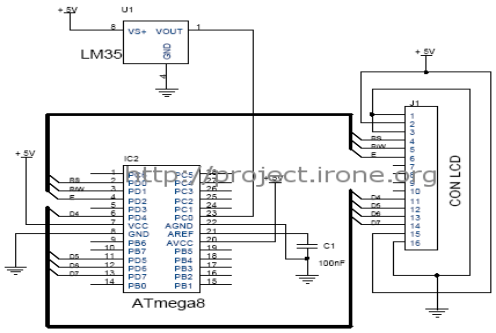


Fig 2.2: Temperature sensor using Atmel 328 microcontroller

The LM317 serves a wide variety of applications including local, on card regulation. This device can also be used to make a programmable output regulator, or by connecting a fixed resistor between the adjustment and output, the LM317 can be used as a precision current regulator. The hardware consists of a six-button interface, four LEDs, a piezo tweeter or sounder, a LM35 temperature sensor and PIR sensor, an AVR ATMega328 microcontroller and some other passive parts. Two LEDs connected to PORTD0 and PORTD1 pins simulate on and off operation of relay switches that are actually present in actual applications to control a temperature. Finally all information are passed through microcontroller and it produce pulse with modulation signal for human sensing purpose at particular time period pulse with modulation signal also passed through LCD display, with help of motor circuit fan speeds are varied.

B. ATMEL IC 328

1. INTRODUCTION

The ATmega48PA/88PA/168PA/328P is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. The word pin can be referred to as the metal connectors on the package of the controller chip. While some of those pins can be freely used within your programs, some have purposes for example to supply voltage. There are also some pins, which are both: They normally have a distinctive

purpose, but in some applications can also be used freely. The electric connector pins that are not configurable cannot be accessed from within the software. So whenever the word pin is used in the following text, the ones that are accessible from inside the software are meant.

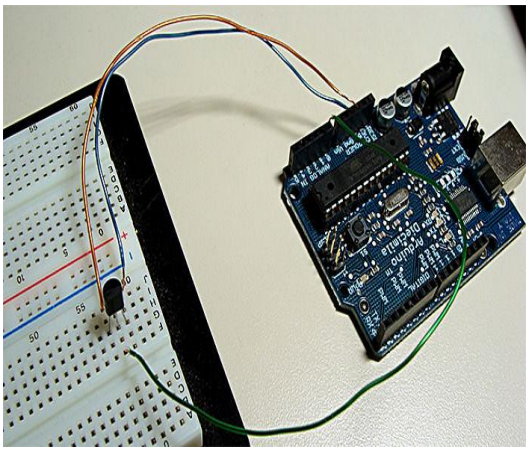


Fig 2.3: Atmel 328 audino uno microcontroller kit

Generally every (software) pin can be used as a digital input or output. This means that it can either "listen" to the signal that is supplied to the pin or provide a signal itself. These two behaviors are called the Data Direction. A processor has a set of registers which contain data or control the peripheral devices. A microcontroller typically is nothing more than a microprocessor with memory, some special hardware (counter, ADCs,.) and direct access to IO. The Atmega series we are using has a 8 bit architecture. It can calculate values of the size of 1 byte at normally one clock cycle. For this reason 8 pins are combined to 1 port, which simply is represented by one register in the CPU. Ports are enumerated with capital letters (A,B,C,. . .), pins with number from 0 .....7. For example PIND6 represents the pin no. 6 on port D each bit in a register for IO represents a (physical) pin. This makes it necessary to know how to manipulate just several bits at a time while leaving the others untouched. If you are not familiar with bit shifting and bit algebra in expressions like a |= (1<<5);

2. OPERATION

The AVR core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The resulting The ATmega48PA/88PA/168PA/328P provides the following features: 4/8/16/32K bytes of In-System Programmable Flash with Read-While-Write capabilities, 256/512/512/1K bytes EEPROM, 512/1K/1K/2K bytes SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible Timer/Counters with compare modes, internal and external interrupts, a serial programmable USART, a byte-oriented 2-wire Serial Interface, an SPI serial port, a 6-channel 10-bit ADC (8 channels in TQFP and QFN/MLF packages). A programmable Watchdog Timer with internal Oscillator, and five software selectable power saving modes. The Idle mode stops the CPU while allowing the SRAM, Timer/Counters, USART, 2-wire Serial Interface, SPI port, and interrupt system to continue functioning. The Power-down mode saves the register contents but freezes the Oscillator and five software selectable power saving modes. The Idle mode stops the CPU while allowing the SRAM, Timer/Counters, USART, 2-wire Serial Interface, SPI port, and interrupt system to continue functioning. In Power-save mode, the asynchronous timer continues to run, allowing the user to maintain a timer base while the rest of the device is sleeping. The ADC Noise Reduction mode stops the CPU and all I/O modules except asynchronous timer and ADC, to minimize switching noise during ADC conversions. In Standby mode, the crystal/resonator Oscillator is running while the rest of the device is sleeping. This allows very fast start-up combined with low power consumption.

2. PIN CONFIGURATION

VCC

Digital supply voltage.

GND

Ground.

Port B (PB7:0) XTAL1/XTAL2/TOSC1/TOSC2

Port B is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port B output buffers have symmetrical drive characteristics with both high sink and source capability. Depending on the clock selection fuse settings, PB7 can be used as output from the inverting Oscillator amplifier. If the Internal Calibrated RC Oscillator is used as chip clock source, PB7..6 is used as TOSC2..1 input for the Asynchronous Timer/Counter2 if the AS2 bit in ASSR is set. The various special features of Port B are elaborated.

Port C (PC5:0)

Port C is a 7-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The PC5...0 output buffers have symmetrical drive characteristics with both high sink and source capability.

PC6/RESET

If the RSTDISBL Fuse is programmed, PC6 is used as an I/O pin. Note that the electrical characteristics of PC6 differ from those of the other pins of Port C. If the RSTDISBL Fuse is unprogrammed, PC6 is used as a Reset input.

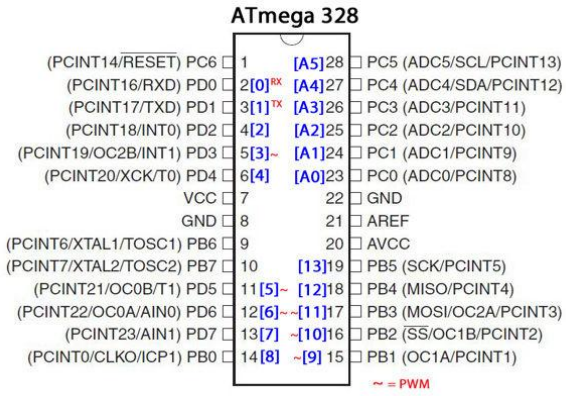


Fig 2.4 pin diagram of Atmel IC 328

Port D (PD7:0)

Port D is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port D output buffers have symmetrical drive characteristics with both high sink and source capability.

AVCC

AVCC is the supply voltage pin for the A/D Converter, PC3:0, and ADC7:6. It should be externally connected to VCC, even if the ADC is not used.

AREF

AREF is the analog reference pin for the A/D Converter.

ADC7:6 (TQFP and QFN/MLF Package Only)

In the TQFP and QFN/MLF package, ADC7:6 serve as analog inputs to the A/D converter. These pins are powered from the analog supply and serve as 10-bit ADC channels.

C. GSM Modem

A **GSM modem** is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. From the mobile operator perspective, a GSM modem looks just like a mobile phone. When a GSM modem is connected to a computer, this allows the computer to use the GSM modem to communicate over the mobile network. While these GSM modems are most frequently used to provide mobile internet connectivity, many of them can also be used for sending and receiving SMS and MMS messages. A GSM modem can be a dedicated modem device with a serial, USB or Bluetooth connection, or it can be a mobile phone that provides GSM modem capabilities. For the purpose of this document, the term GSM modem is used as a generic term to refer to any modem that supports one or more of the protocols in the GSM evolutionary family, including the 2.5G technologies GPRS and EDGE, as well as the 3G technologies WCDMA, UMTS, HSDPA and HSUPA. A GSM modem exposes an interface that allows applications such as Now SMS to send and receive messages over the modem interface. The mobile operator charges for this message sending and receiving as if it was performed directly on a mobile phone. To perform these tasks, a GSM modem must support an "extended AT command set" for sending/receiving SMS messages, as defined in the ETSI GSM 07.05 and 3GPP TS 27.005 specifications. GSM modems can be a quick and efficient way to get started with SMS, because a special subscription to an SMS service provider is not required. In most parts of the world, GSM modems are a cost effective solution for receiving SMS messages, because the sender is paying for the message delivery. Due to some compatibility issues that can exist with mobile phones, using a dedicated GSM modem is usually preferable to a GSM mobile phone. This is more of an issue with MMS messaging, where if you wish to be able to receive inbound MMS messages with the gateway, the modem interface on most GSM phones will only allow you to send MMS messages. This is because the mobile phone automatically processes received MMS message notifications without forwarding them via the modem interface.

A GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. From the mobile operator perspective, a GSM modem looks just like a mobile phone.

A GSM modem can be a dedicated modem device with a serial, USB or Bluetooth connection, or it may be a mobile phone that provides GSM modem capabilities. A GSM modem could also be a

standard GSM mobile phone with the appropriate cable and software driver to connect to a serial port or USB port on your computer.

III. HARDWARE RESULT

The hardware output considered two types of sensor based. PIR sensors allow you to sense motion, almost always used to detect whether a human has moved in or out of the sensors range. When the PIR detects motion, the output pin will go "high" to 3.3V and light up the LED. Once insert batteries and wait 30-60 seconds for the PIR to 'stabilize' during that time the LED may blink a little. Wait until the LED is off and then move around in front of it, waving a hand.

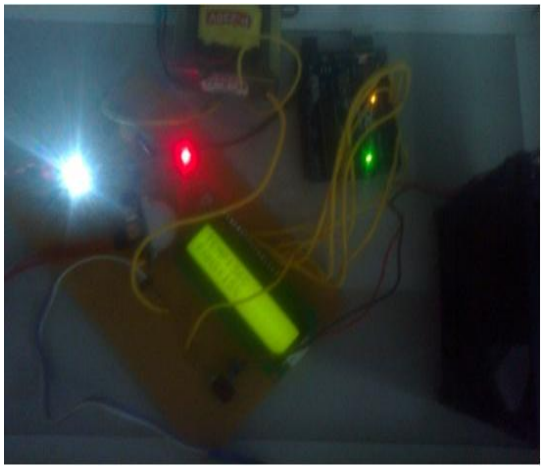


Fig 3.1 PIR Sensor sense and display Temperature

The PIR sensor itself has two slots in it; each slot is made of a special material that is sensitive to IR When the sensor is idle, both slots detect the same amount of IR, the ambient amount radiated from the room or walls or outdoors

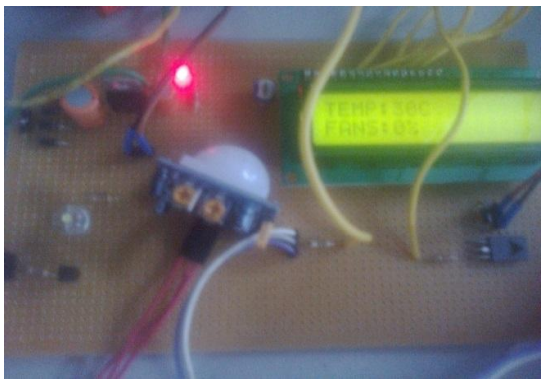


Fig 3.2 Temperature sensor only sense and display fan speed

Temperature sensor using one **LM35 Precision Temperature Sensor** and Arduino, so it can mostly use for future works. The circuit will send serial information about the temperature with help of LCD, finally that information are passed through microcontroller the temperature sensor sense all temperature range that values are displays with help LCD and simultaneously change the fan speed. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy The LM35D is also available in an 8-lead surface mount small outline package and a plastic TO-220 package.

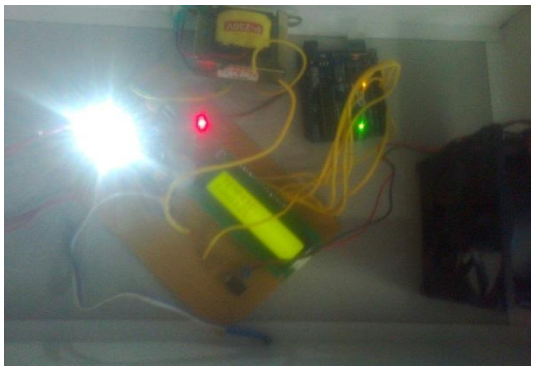


Fig 3.3 PIR and Temperature sensor both are sensed display fan speed and Temperature range

IV. SOFTWARE RESULTS- ARDUINO

1. INTRODUCTION

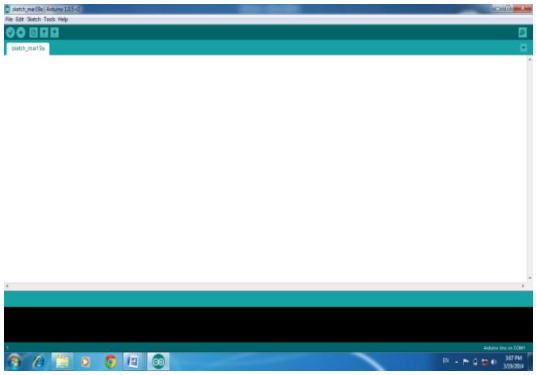
Arduino is a tool for making computers that can sense and control more of the physical world than your desktop computer. It's an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board. Arduino can be used to develop interactive objects, taking inputs from a variety of switches or sensors, and controlling a variety of lights, motors, and other physical outputs. Arduino projects can be stand-alone, or they can communicate with software running on your computer (e.g. Flash, Processing, Max MSP.). The Arduino programming language is an implementation of Wiring, a similar physical computing platform, which is based on the Processing multimedia programming environment.

2. PROGRAMMING WITH ARDUINO

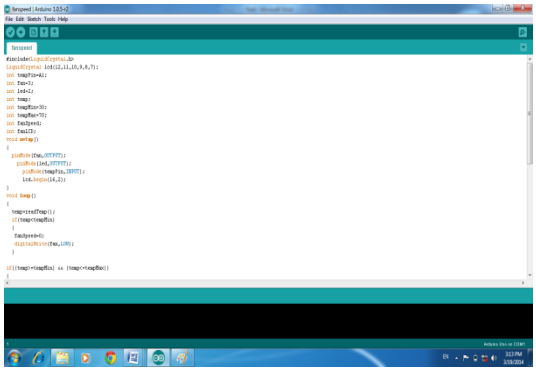
There are many other microcontrollers and microcontroller platforms available for physical computing. Parallax Basic Stamp, Net media's BX-24, Phidgets, MIT's Handy board, and many others offer similar functionality. All of these tools take the messy details of microcontroller programming and wrap it up in an easy-to-use package.

3. SIMULATION RESULTS

Step 1:Open the arduino and create the new file



Step 2: Write program code and save the file



Step 3: Click on sketch menu and then click verify to run the program.

V. CONCLUSION

The objective of the project is to design, simulate and assemble a microcontroller based energy saving unit so as to reduce the power consumption because saving energy has become one of the most important issues these days. A light accounts for approximately 20 percent of the world's total energy consumption; thus, a lot of studies and developments related to energy saving of a light have been done by various researchers all over the world. However, since there are no products considering both energy efficiency and user satisfaction, the existing systems cannot be successfully applied to home and office buildings. Therefore, we propose an intelligent household LED application and lighting system considering energy efficiency and user satisfaction. In communication technology in order to control an LED light according to the user's state and the surroundings. This is just an initial development stage of handling power consumption in household and building purpose. So adding multipurpose sensors in home and building application as to reduce the power consumption and also to improve the quality of service to the consumers.

REFERENCES

[1] L. G. M. Gouveia, "Sistema de monitorização do nível de enchimentode ecopontos," Master's thesis, Universidade de Aveiro, 2009.

[2] Akyildiz, I.F.; Weilian Su; Sankarasubramaniam, Y.; Cayirci, E.; , "Asurvey on sensor networks," Communications Magazine, IEEE , vol.40,no.8, pp. 102- 114, Aug 2002 doi: 10.1109/MCOM.2002.1024422.

[3] Wireless Medium Access Control (MAC) and Physical Layer (PHY)Specifications for Low-Rate Wireless Personal Area Networks(WPANs), IEEE Std., Rev. IEEE Std 802.15.4-2006, 2006.

[4] Dongliang Duan; Fengzhong Qu; Wenshu Zhang; Liuqing Yang; ,"Optimizing the battery energy efficiency in wireless sensor networks,"Signal Processing, Communications and Computing (ICSPCC), 2011IEEE International Conference on , vol., no., pp.1-6, 14-16 Sept. 2011.

[5] Rui Gao; Hong Zhou; Gang Su; , "Structure of Wireless Sensors Network Based on TinyOS," Control, Automation and Systems Engineering (CASE), 2011 International Conference on , vol., no.,pp.1-4, 30-31 July 2011.

[6] Wei Dong; Chun Chen; Xue Liu; Yunhao Liu; Jiajun Bu; Kougen Zheng; , "SenSpire OS: A Predictable, Flexible, and Efficient Operating System for Wireless Sensor Networks," Computers, IEEE Transactions on , vol.60, no.12, pp.1788-1801, Dec. 2011.

[7] ZES ZIMMER Electronic Systems, "LMG95 Single Phase Precision Power Analyzer", January 2011. [Online]. Available:http://www.zes.com/english/products/single-phase-precision-poweranalyzer-lmg95.html.

[8] Keithley Instruments, "2100 USB Digital Multimeter", January 2011.[Online]. Available:http://www.keithley.com/products/dcac/dmm/broadpurpose/?mn=2100120.

[9] Texas Instruments, "CC2530 Evaluation Module Kit", October 2010.[Online]. Available:http://focus.ti.com/docs/toolsw/folders/print/cc2530emk.html.

[10] Texas Instruments, "CC2530 Development Kit", October 2010. [Online].Available: http://focus.ti.com/docs/toolsw/folders/print/cc2530dk.html.

[11] SAFT LS17500 battery, "3.6V Primary lithium-thionyl chloride (Li – SOCl2) battery", January 2011. [Online]. Available:http://www.saftbatteries.com.

[12] Texas Instruments, "Second Generation System-on-Chip Solution for2.4 GHz IEEE 802.15.4 / RF4CE / ZigBee," October 2010. [Online].Available: http://focus.ti.com/docs/prod/folders/print/cc2530.html.

[13] Dunkels, A.; Gronvall, B.; Voigt, T.; , "Contiki - a lightweight and flexible operating system for tiny networked sensors," Local Computer Networks, 2004. 29th Annual IEEE International Conference on, vol.,no ., pp. 455- 462, 16-18 Nov. 2004.