ZIGBEE NETWORK SYSTEM BASED ACTIVITIES OF WORK VEHICLES

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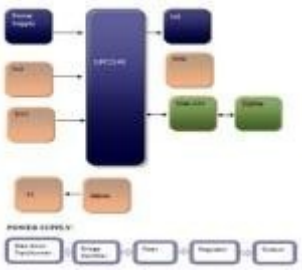
ABSTRACT: Observing activities of working vehicles on a work site, such as a factory, is important in regard to managing the lifetime of vehicles and achieving high operational availability. However, it is a problem that an administrator cannot completely grasp the activities of a working vehicle. Existing systems cannot cover a large area, particularly in an indoor environment. A system is proposed for monitoring operating activities of working vehicles, regardless of whether they are operating indoors or outdoors. The system calculates the activity rate of a vehicle by analyzing the topology of a network configured by the wireless technology ZigBee. In addition, it was experimentally verified that network topology and RSSI can be used to estimate activities of working vehicles.

Keywords: ZigBee; Sensor Network; Activity; Status;

1.INTRODUCTION

EMBEDDED SYSTEMS: Each day, our lives become more dependent on 'embedded systems', digital information technology that is embedded in our environment. More than 98% of processors applied today are in embedded systems, and are no longer visible to the customer as 'computers' in the ordinary sense. An Embedded System is a special- purpose system in which the computer is completely encapsulated by or dedicated to the device or system it controls. Unlike a general-purpose computer, such as a personal computer, an embedded system performs one or a few pre-defined tasks, usually with very specific requirements. Since the system is dedicated to specific tasks, design engineers can optimize it, reducing the size and cost of the product. Embedded systems are often mass-produced, benefiting from economies of scale. The increasing use of PC hardware is one of the most important developments in high-end embedded systems in recent years. Hardware costs of high-end systems have dropped dramatically as a result of this trend, making feasible some projects which previously would not have been done because of the high cost of non-PC-based embedded hardware. But software choices for the embedded PC platform are not nearly as attractive as the hardware.

Typically, an embedded system is housed on a single microprocessor board with the programs stored in ROM. Virtually all appliances that have a digital interface -- watches, microwaves, VCRs, cars -- utilize embedded systems. Some embedded systems include an operating system, but many are so specialized that the entire logic can be implemented as a single program



1.Overview of an Embedded System Architecture

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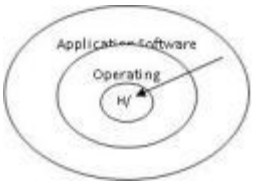
Every Embedded system consists of a custom-built hardware built around a central processing unit. This hardware also contains memory chips onto which the software is loaded.



The operating system runs above the hardware and the application software runs above the operating system. The same architecture is applicable to any computer including desktopcomputer. However these are significant differences. It is not compulsory to have an operating system in every embedded system. For small applications such as remote control units, air conditioners, toys etc.

2. ARM LPC2148: The LPC2141/42/44/46/48

microcontrollers are based on a 16-bit/32-bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combine microcontroller with embedded high speed flash memory ranging from 32kB to 512 kB. . For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30 % with minimal performance penalty. Due to their tiny size and low power consumption, LPC2141/42/44/46/48 are ideal for applications where miniaturization is a key requirement, such as access control and point-of-sale. Serial communications interfaces ranging from a USB

2.00 Full-speed device, multiple UARTs, SPI, SSP to I2C-bus and on-chip SRAM of 8 kB up to 40 kB, make these devices very well suited for communication gateways and protocol converters, soft modems, voice recognition and low end imaging, providing both large buffer size and high processing power.

Various 32-bit timers, single or dual 10-bit ADC(s),10-bit DAC,PWM channels and 45 fast GPIO lines with upto nine for the board to setup, once the signal is gone, the CPU starts immediately. However, if the reset signal latches wake up timer starts. During this time, the board setup itself. If the reset signal latches longer than the time However, if the reset signal latches shorter than the time taken for the board to setup, once the signal is gone, the board waits for the wake up time to finish its first loop before starting the CPU (See Figure 3). these microcontrollers suitable for industrial control and medical systems nine edge or level sensitive external interrupt pins make

2. LITERATURE SURVEY

EXISTING SYSTEM

GPS is a typical way for achieving such positioning; however, it cannot be used in indoor environments because GPS signals are blocked by wallsceilings The Global Positioning System (GPS),originally Navstar GPS,[1] is a satellite-based radionavigation system owned by the United StatesUnited States government and operated by the United States Air Force.[2] It is a global navigation satellite system that provides geolocationand time information to a GPS receiver anywhere on or near the Earth where there is

an unobstructed line of sight to four or more GPS satellites.[3]

Disadvantage:

It requires vehicle to be in outdoor for correct positioning.

PROPOSED SYSTEM

This system utilizes a ZigBee device attached to a working vehicle to observe the activities of the vehicle. The system collects topology and RSSI data from the network built by the ZigBee. These data are used for estimating relative positions of the working vehicles. The activity rate of each working vehicle is calculated by analysing the position information in a time-series manner. Finally, the calculated activity rate of each working vehicle is displayed.

Advantages:

1. No need of external microcomputer since ZigBee has inbuilt one in it.
2. The links between the nodes are established with probability of 95%.
3. PIPELINING

An instruction cycle has 3 stages:

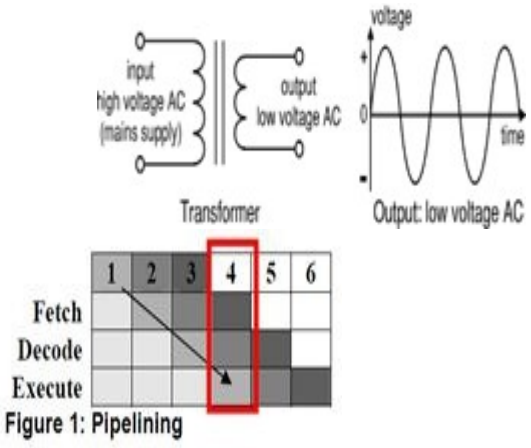


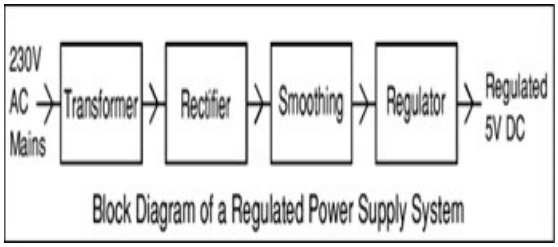
Figure 1: Pipelining

During the execution of the 1st instruction, the 2nd instruction being decode and the 3rd instruction is being fetch. See the Figure 1 below

RESET AND WAKEUP TIMER:

LPC2148 can be reset in 2 ways; from the RESET button or Watch Dog Timer. taken for the board to setup, once The signal is gone, , the CPU starts immediately wake up timer starts. During this time, the board setup itself. If the reset signal latches longer than the time However, if the reset signal latches shorter than the time taken for the board to setup, once the signal is gone, the board waits for the wake up time to finish its first loop before starting the CPU (See Figure 3).

4. HARD WRE REQURIED



Block Diagram of a Regulated Power Supply System

For example a 5v regulated supply:

Each of the blocks is described in more detail below:

Transformer - steps down high voltage AC mains to low voltage AC.

Rectifier - converts AC to DC, but the DC output is varying.

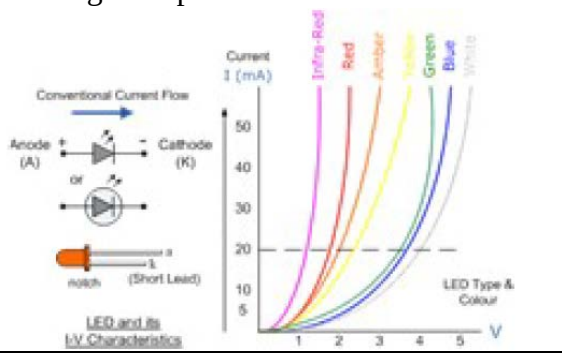
Smoothing - smoothes the DC from varying greatly to a small ripple.

Regulator - eliminates ripple by setting DC output to a fixed voltage.

Power supplies made from these blocks are described below with a circuit diagram and a graph of their output:

TRANSFORMER ONLY LIGHT EMITTING DIODES I-V CHARACTERISTICS

Before a light emitting diode can "emit" any form of light it needs a current to flow through it, as it is a current dependant device. As the LED is to be connected in a forward bias condition across a power supply it should be Current Limited using a series resistor to protect it from excessive current flow. From the table above we can see that each LED has its own forward voltage drop across the PN-junction and this parameter which is determined by the semiconductor material used is the forward voltage drop for a given amount of forward conduction current, typically for a forward current of 20mA. In most cases LEDs are operated from a low voltage DC supply, with a series resistor to limit the forward current to a suitable value from say 5mA for a simple LED indicator to 30mA or more where a high brightness light output is needed.



RS232 Line Type & Logic Level	RS232 Voltage	TTL Voltage to/ from MAX232
Data Transmission (Rx/Tx) Logic 0	+3V to +15V	0V
Data Transmission (Rx/Tx) Logic 1	-3V to -15V	5V
Control Signals (RTS/CTS/DTR/DSR) Logic 0	-3V to -15V	5V
Control Signals (RTS/CTS/DTR/DSR) Logic 1	+3V to +15V	0V

Communication can happen right after the association. Direct addressing uses both radio address and endpoint identifier, whereas indirect addressing uses every relevant field (address, endpoint, cluster and attribute) and requires that

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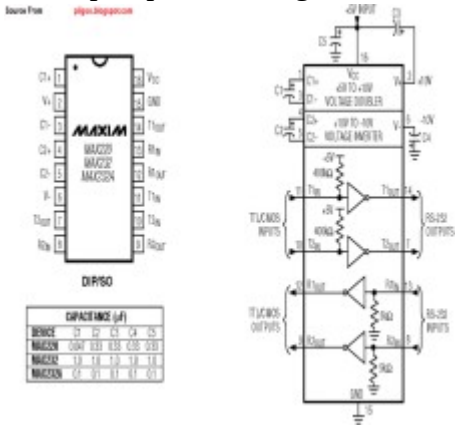
they be sent to the network coordinator, which maintains associations and translates requests for communication. Indirect addressing is particularly useful to keep some devices very simple and minimize their need for storage. Besides these two methods, broadcast to all endpoints in a device is available, and group addressing is used to communicate with groups of endpoints belonging to a set of devices The receivers reduce RS-232 inputs (which may be as high as ± 25 V), to standard 5 V TTL levels. These receivers have a typical threshold of 1.3 V, and a typical hysteresis of 0.5 V. The later MAX232A is backwards compatible with the original MAX232 but may operate at higher baud rates and can use smaller external capacitors – 0.1μF in place of the 1.0μF capacitors used with the original device. The newer MAX3232 is also backwards compatible, but operates at a broader voltage range, from 3 to 5.5V..

PIN DIAGRAM OF MAX232

Max232 is designed by Maxim Integrated Products. This IC is widely used in RS232 Communication systems in which the conversion of voltage level is required to make TTL devices to be compatible with PC serial port vice versa. This chip contains charge pumps which pumps the voltage to the Desired Level



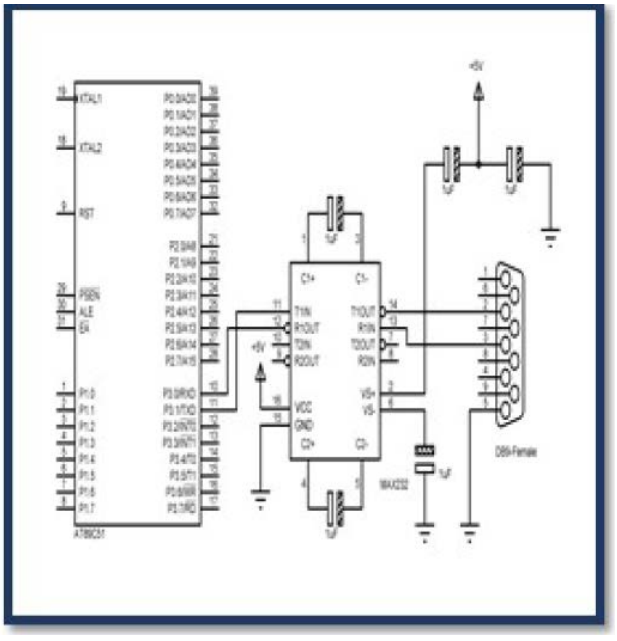
4.3 TYPICAL APPLICATIONS

The MAX232(A) has two receivers that convert from RS-232 to TTL voltage levels, and two drivers that convert from TTL logic to RS-232 voltage levels. As a result, only two out of all RS- 232 signals can be converted in each direction. Typically, the first driver/receiver pair of the MAX232 is used for TX and RX signals, and the second one for CTS and RTS signals.

4.4 VOLTAGE LEVELS

TIA-232 line type and logic level	**TIA-232 voltage**	**TTL voltage to/from MAX232**
Data transmission (Rx/Tx) logic 0	+3 V to +15 V	0 V
Data transmission (Rx/Tx) logic 1	−3 V to −15 V	5 V
Control signals (RTS/CTS/DTR/DSR) logic 0	−3 V to −15 V	5 V
Control signals (RTS/CTS/DTR/DSR) logic 1	+3 V to +15 V	0 V

It is helpful to understand what occurs to the voltage levels. When a MAX232 IC receives a TTL level to convert, it changes a TTL Logic 0 to between +3 and +15V, and changes TTL Logic 1 to between -3 to -15V, and vice versa for converting from RS232 to TTL. This can be confusing when you realize that the RS232 Data Transmission voltages at a certain logic state are opposite from the RS232 Control Line voltages at the same logic state. To clarify the matter, see the table below.



5. TECHNICAL OVERVIEW

ZigBee is a low-cost, low-power, wireless mesh network standard. The low cost allows the technology to be widely deployed in wireless control and monitoring applications. Low power- usage allows longer life with smaller batteries. Mesh networking provides high

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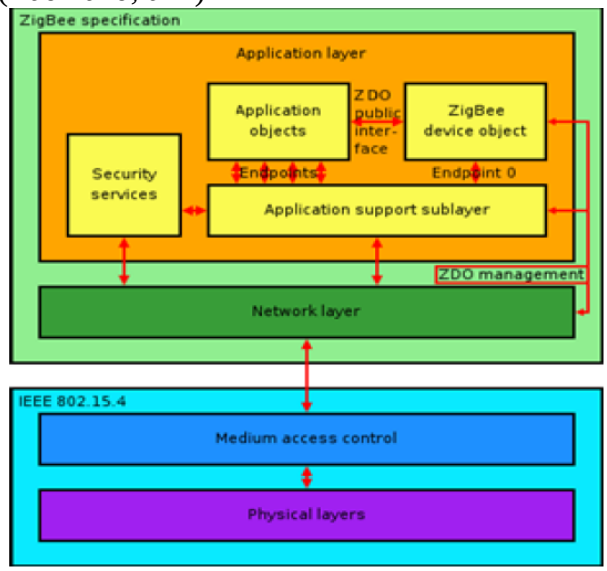
reliability and more extensive range. ZigBee chip vendors typically sell integrated radios and microcontrollers with between 60 KB and 256 KB flash memory

Zigbee is a wireless technology developed as an open global standard to address the unique needs of low-cost, low-power wireless IoT networks. ...

The Zigbeestandard operates on the IEEE 802.15.4 physical radio specification and operates in unlicensed bands including 2.4 GHz, 900 MHz and 868 MHz..

Zigbee is not a product, rather it is a protocol developed by the Zigbee alliance, that allows for the universal compatability of devices created by different manufacturers all over the world for use in a wireless home management system (Zigbee 2011). Zigbee's relatively low priced wireless home synchronization specification is carried over the IEEE 802.15.4 architecture (Radmand, unk)



6. ZIGBEE IN OUR PROJECT

Typical applications without special security needs will use a network key provided by the trust center (through the initially insecure channel) to communicate.Thus, the trust center maintains both the network key and provides point-to-point security. Devices will only accept communications originating from a key provided by the trust center, except for the initial master key. The security architecture is distributed among the network layers as follows:

1. The MAC sub layer is capable of single-hop reliable communications. As a rule, the security level it is to use is specified by the upper layers.
2. The network layer manages routing, processing received messages and being capable of broadcasting requests. Outgoing frames will use the adequate link key according to the routing, if it is available; otherwise, the network key will be used to protect the payload from external devices. 3.The application layer offers key establishment and transport services toboth ZDO and applications.

4. It is also responsible for the propagation across the network of changes in devices within it, which may originate in the devices themselves (for instance, a simple status change) or in the trust manager (which may inform the network that a certain device is to be eliminated from it). It also routes requests from devices to the trust center and network key renewals from the trust center to all devices. Besides this, the ZDO maintains the security policies of the device.

The security levels infrastructure is based on CCM*, which adds encryption- and integrity-only features to CCM.

Chip vendors/devices include

To become ZigBee certified as a semiconductor company, vendors must ensure their applications are interoperable. Periodic interoperability events verify that devices work with other certified devices.

Atmel ATmega128RFA1, AT86RF230/231

- Digi International XBee XB24CZ7PIS-004
- Ember EM250, EM351, EM357
- Free scale MC13224, MC13226
- Green Peak GP520-GP530-GP540

KEIL SOFTWARE

The Keil 8051 Development Tools are designed to solve the complex problems facing embedded software developers. When starting a new project, simply select the

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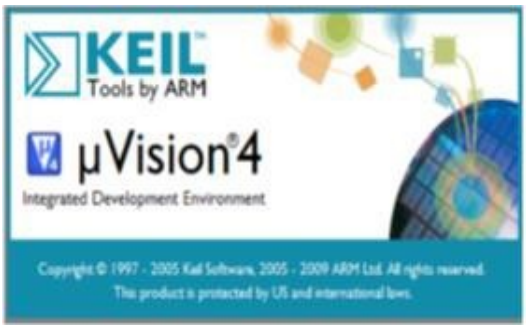
microcontroller you use from the Device Database and the

µVision IDE sets all compiler, assembler, linker, and memory options for you.

KEIL SOFTWARE WORKING

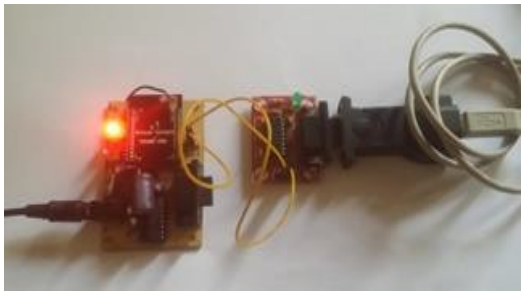


KIT

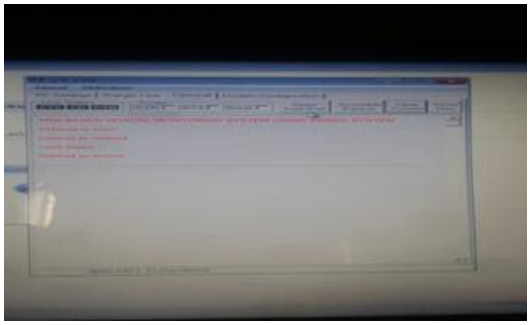
Zigbee is an IEEE 802.15.4-based specification for a suite of high-level communication protocols used to create personal area networks with small, low-power digital radios, such as for home automation, medical device data collection, and other low-power low-bandwidth needs, designed for small scale projects which need wireless connection.

TRANSMITTER

RECEIVER



OUTPUT



ADVANTAGES

By this system we can monitor the vehicle working from far distance.

Reduce the man power for machinery. Saving the time and money.

APPLICATIONS

We can use this system in mining area. In chemical industries.

In dangerous area, prohibited area

And used in industries like glasses making, steel mining etc..

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CONCLUSION

A system is proposed for monitoring the operating activities of working vehicles, regardless of whether they are operating indoor or outdoor. The proposed system determines the relative positional relationship between the working vehicle from a change in the ZigBee topology and RSSI. The topology is estimated by a combination of response-time estimation and node search (a standard function of ZigBee). It was found that the response time between adjacent devices is 30 ms or less. Based on these experimental results, an algorithm for estimating the patterns of activities of working vehicles was proposed. This algorithm was used for in an experiment on collecting topology data from AGVs. The results of the experiment indicate

that the operating activities of each AGV differ according to working hours.

In the future, to grasp the activity of a working vehicle by creating an activity pattern, the proposed system will be evaluated experimentally. In addition, a function for visualizing the activity of working vehicles on a tablet will be implemented. This study was partly supported by SCAT.

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