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A Dynamic Secret Based Encryption Scheme for Smart Grid Wireless Communication

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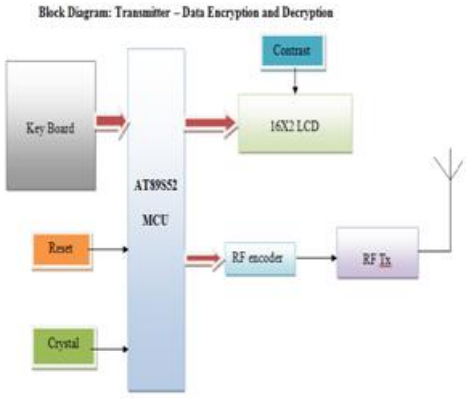
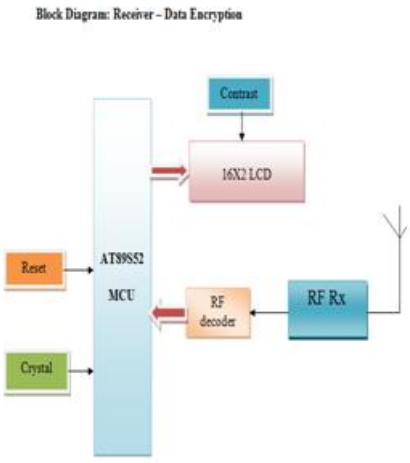
Abstract:
In this project, the data can be transmitted to and received from remote Zigbee communication device. Data Security is primary concern for every communication system. There are many ways to provide security data that is being communicated. However, what if the security is assured irrespective of the hackers are from the noise. This Project describes a design of effective security for data communication by designing standard algorithm for encryption and decryption. The source information is generated by PS2 Keyboard and this will be encrypted and is sent to destination through Zigbee modules. The receiving system will check the data according to a specific algorithm and displays on the LCD. The project is built around the controller in the transmitter and receiver section. This controller provides all the functionality of the display and wireless control. It also takes care of creating different display effects for given text.

Existing System:
The source information is generated by a key Board and this will be encrypted and is sent to destination through RF communication. The receiving system will check the data and decrypt according to a specific algorithm and displays on the LCD. The RF modules used here acts as a Transceiver. Encrypted information at the Transceiver end will send the information to the other end. This decrypted data will be displayed. And note that at the decrypted end the user has to press a special key "Decryption " to get the as it is information on the 16X2 LCD.





Draw Backs:
- RF is implemented with shorter distance only.
- There is no encryption key.
- Grid information is not calculated.

Proposed System:
Alphanumerical keyboard is interfaced to the transmitter to type the data and transmit. The message can be transmitted to multi point receivers.

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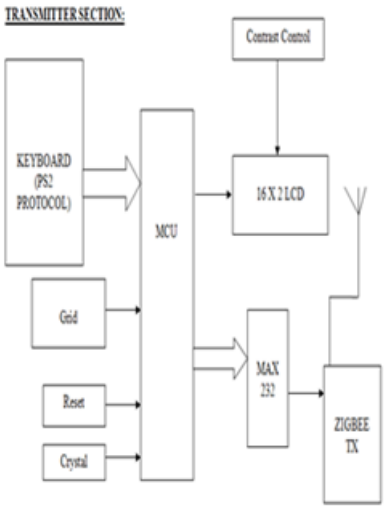
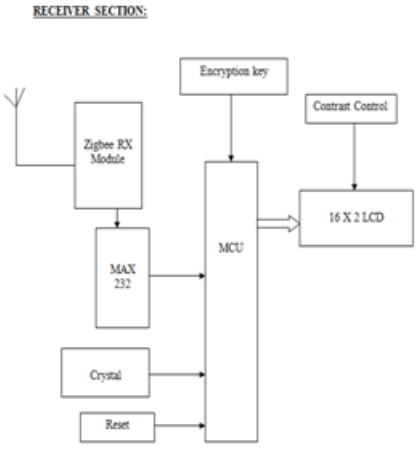
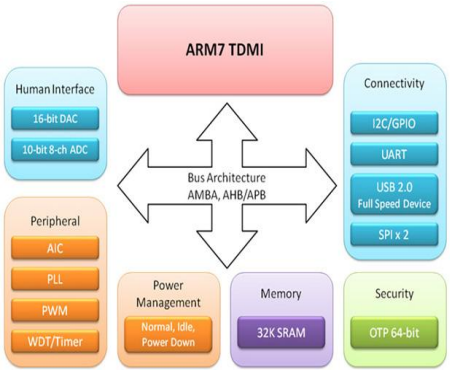
After entering the text, the user can disconnect the keyboard. At any time the user can add or remove or alter the text according to his requirement. Whenever the message is transmitted to the receiver section the garbage or junk message will be displayed on the receiver section 16X2 LCD. In order to read the original message the user should press the encryption key which is connected in the receiver section. Here we can also have the knowledge about the consuming units of the loads connected through the same wireless network. For example if 2 loads (fan, light) are connected and it has consumed 5 units that will be displayed in LCD at the receiver section. So that we can not only have the data with security but also we can have the knowledge about the loads connected.





Keywords:
ARM7-LPC2148, Zigbee, Smart Grid, data encryption

The LPC2148 are based on a 16/32 bit ARM7TDMI-S™ CPU with real-time emulation and embedded trace support, together with 128/512 kilobytes of embedded high speed flash memory. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at maximum clock rate. For critical code size applications, the alternative 16-bit Thumb Mode reduces code by more than 30% with minimal performance penalty. With their compact 64 pin package, low power consumption, various 32-bit timers, 4- channel 10-bit ADC, USB PORT,PWM channels and 46 GPIO lines with up to 9 external interrupt pins these microcontrollers are particularly suitable for industrial control, medical systems, access control and point-of-sale. With a wide range of serial communications interfaces, they are also very well suited for communication gateways, protocol converters and embedded soft modems as well as many other general-purpose applications.



This project uses regulated 3.3V, 500mA power supply. Unregulated 12V DC is used for relay. 7805 three terminal voltage regulator is used for voltage regulation. Bridge type full wave rectifier is used to rectify the ac output of secondary of 230/12V step down transformer.

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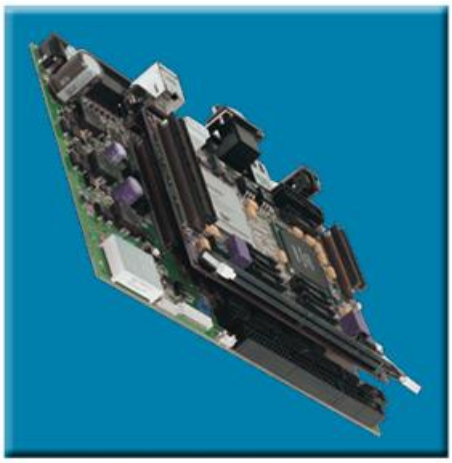
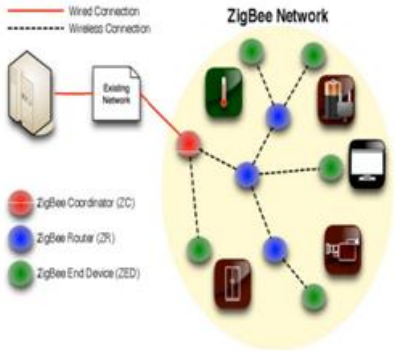
ARM PROCESSOR:



ARM7TDMI Processor Core

- Current low-end ARM core for applications like digital mobile phones
- TDMI
  - T: Thumb, 16-bit compressed instruction set
  - D: on-chip Debug support, enabling the processor to halt in response to a debug request
  - M: enhanced Multiplier, yield a full 64-bit result, high performance
  - I: Embedded ICE hardware
- Von Neumann architecture

Zigbee



It is the wireless device for transmitting and receiving purpose or simply it called as Transceiver. Zigbee is based on the IEEE802.15.4 protocol. The range of the Zigbee is covered as 100m. It range is 10 times better than Bluetooth device so it can be more preferable one in wireless device. The data rate is very low for transmission while using this device.

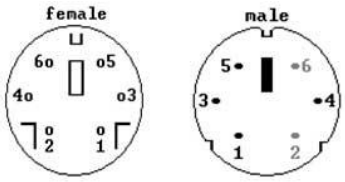
Zigbee is a PAN technology based on the IEEE 802.15.4 standard. Unlike Bluetooth or wireless USB devices, ZigBee devices have the ability to form a mesh network between nodes. Meshing is a type of daisy chaining from one device to another. This technique allows the short range of an individual node to be expanded and multiplied, covering a much larger area.

Technical Specifications of Zigbee

- Frequency band2.400 — 2.483 GHz
- Number of channels16
- Data rate250 kbps
- Supply voltage1.8 – 3.6 V
- Flash memory128 kB
- RAM8 kB
- EEPROM4 kBOperating
- Temperature-40 — +85 °C

PS/2 (Play Station 2):

The PS/2 connector is a round shape of 6-pin Mini-DIN connector used for connecting some keyboards and mice to a PC compatible computer system.



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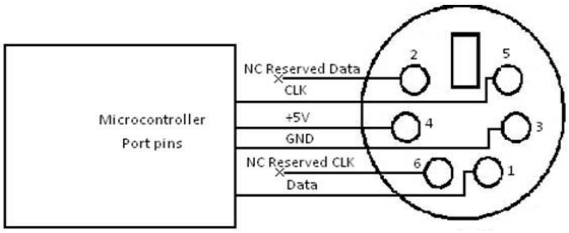
Interfacing PS/2:

Fig. 1 shows how to interface PS/2 port to microcontroller. The PS/2 bus includes both clock and data. Both a mouse and keyboard drive the bus with identical signal timings and both use 11-bit words that include a start, stop and odd parity bit. However, the data packets are organized differently for a mouse and keyboard. Furthermore, the keyboard interface allows bidirectional data transfers so the host device can illuminate state LEDs on the Keyboard.

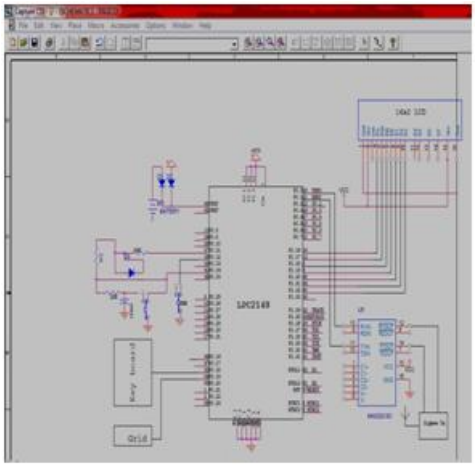


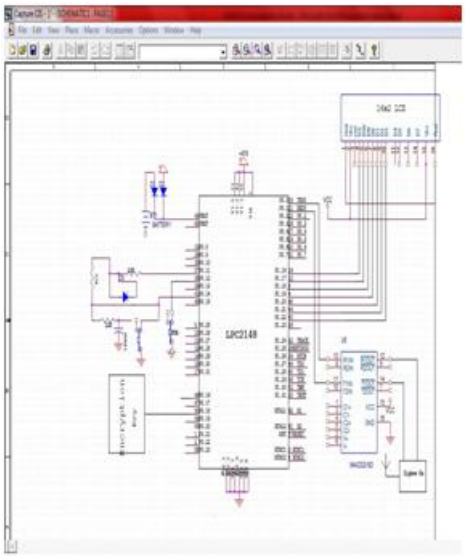
Interfacing PS/2 to Microcontroller

Grid:

The term grid usually refers to a network, and should not be taken to imply a particular physical layout or breadth. Grid may also be used to refer to an entire electrical network, a regional transmission network or may be used to describe a sub network such as a local utility's transmission grid or distribution grid.

Interfacing Diagram:





Applications:

Offices
Educational institutions
Bus stations
Railway stations

Advantages:

Wireless System Text can be entered from remote place Consumed units by different loads can be known at other place Data will not be lost in power failure condition

Future scope:

Further this application can be implemented with the help of GSM technology.

Hardware Kit

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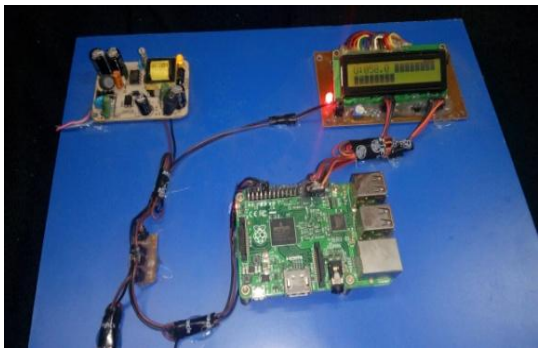
Result:



Conclusion:

Data Security is primary concern for every communication system. Information can be sent with high security to distant place and also one can have the knowledge of number of units consumed by different loads in the other place. An effective security for data communication by designing standard algorithm for encryption and decryption is being done here. This module communicates and provides security through Zigbee technology. So that we can not only have the data with security but also we can have the knowledge about the loads connected.

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BIOGRAPHY:

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He very much interest to do research on VLSI Technology and Design, communication systems and antennas.

Dr. D SubbaRao

Is a proficient Ph.D person in the research area of Image Processing from Vel-Tech University, Chennai along with initial degrees of Bachelor of Technology in Electronics and Communication Engineering (ECE) from Dr. S G I E T, Markapur and Master of Technology in Embedded Systems from SRM University, Chennai. He has 13 years of teaching experience and has published 12 Papers in International Journals, 2 Papers in National Journals and has been noted under 4 International Conferences. He has a fellowship of TheInstitution of Electronics and Telecommunication Engineers (IETE) along with a Life time membership of Indian Society for Technical Education (ISTE). He is currently bounded as an Associate Professor and is being chaired as Head of the Department for Electronics and Communication Engineering discipline at Siddhartha Institute of Engineering and Technology, Ibrahimpatnam, Hyderabad.