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Wireless Bulletin board with timer using Ultra wideband

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Abstract - **A bulletin board (pin board, notice board in British English) is a surface intended for the posting of public messages, for example, to advertise items wanted or for sale, announce events, or provide information. Notice board is the primary thing in any institution/organization. Sticking various notices day to day and removing the old one is a difficult process. This paper deals with advanced wireless notice board. This paper is designed using ARM-LPC2148 interfaced with graphical display. Also in present system only one notice is sent to all the notice board irrespective of their places and also in the existing wireless notice board does not provide the time for user to read the message because it continuously display the message one after another. To overcome this disadvantages here decoder is used to select a particular display and the corresponding information is sent through an arm controller using Ultra Wide Band (UWB) technology and Timer is added to the controller to specify the amount of time the message is to be displayed. The entries can be properly maintained for future references by using Visual Basic (VB). The controller has real time clock used for synchronization of data. A resistive touch screen is used to access and progress the previous one. The monitoring system consists of an image sensor for capturing image for a specified time interval and the image can be transferred to the PC for storage purpose through USB port.**

Key Words: Bulletin board, ARM-LPC2148, Synchronization, Touch Screen, Monitoring system, Timer, Uwb technology

I.INTRODUCTION

This is an embedded project. An embedded system is a combination of hardware and software and each mechanical part perform its own function. The main purpose of this proposed paper is to provide automatic display which reduces the manual operation. The information can be updated at desired location. Updates can be done on the desired display without disturbing the other displays. The message to be displayed is sent as an sms to the GSM module. Then the message is saved in PC for future reference and is sent to the LCD display through the controller .By implementing the timer to the controller we can set the time so that the message displayed duration will be increased.

II.COMPONENTS DESCRIPTION

A. LPC2148 Arm Controller

In this paper we are using LPC2148. ARM is a family of instruction set architectures for computer processors based on a reduced instruction set computing (RISC) architecture. A RISC-based computer design approach means ARM processors require significantly fewer transistors than typical processors in average computers. This approach reduces costs, heat and power use. Multiple serial interfaces have two UARTs, Low power real-time clock with independent power and dedicated 32 kHz clock input. Since we are using both UARTs it is necessary to prioritize the event occurring in the controller.

LPC2148 need minimum below mentioned hardware to work properly.1.Power Supply 2. Crystal Oscillator3. Reset Circuit4. RTC crystal oscillator (This is not necessary if you are not using RTC. However this is considered as a necessary requirement) 5. UART

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Fig -1: LPC Arm Controller

B. Liquid Crystal Display

A 16x2 character LCD with black text on green background is used for notice board. It operates at 5V DC with a duty cycle of 1/16.multiple displays are used among anyone of the display can be chosen for displaying the notice. In this paper we use maximum of 3 LCD displays.

C. Graphical LCD

The Graphical LCDs are thus used to display customized characters and images. The Graphical LCDs find use in many applications; they are used in video games, mobile phones, and lifts etc., as display units. This serial graphic LCD allows the user to write text, draw lines, circles, boxes, and set or reset individual pixels, erase specific block of display, control the backlight and adjust the baud rate. This LCD has a display format of 128x64 dots and has yellow-green colour backlight. Each LCD needs a controller to execute its internal operations. This LCD uses two KS0108 controllers. The 128x64 LCD is divided into two equal halves with each half being controlled by a separate KS0108 controller. Such LCDs (using KS0108 controller) involve paging scheme.

D. UWB Module

UWB techniques depend on symmetric a transmitter and receiver structure, which assumes the same complexity level throughout the network. In single band UWB high rate digital to analog and analog to digital convertor at all nodes. In multi band UWB this assumption means local oscillators and frequency synthesizers at all devices. Which are very power consuming and prone to carrier frequency and phase offsets. To establish physical communication links between nodes asymmetric UWB transceivers need to be designed. This allows the weak nodes to retain low complexity at both the Tx and Rx modes, and vice versa. In asymmetric UWB links, both high complexity and low complexity nodes can exist at the transmitter or receiver end. The low complexity node (LCN) only realizes the simplest single band transmission with low A/D and D/A conversion rate. . The high complexity node (HCN) can be a SB-UWB transceiver with high A/D and D/A conversion rate or with multiple oscillators. We have proved that the asymmetric link model can be converted into multiple input multiple output (MIMO) system model with multiple Tx and Rx antennas. Once the conversation is achieved, the transceiver designed for multi antenna connection can be readily adopted. This is particularly adopted for UWB communication where complexity is a major concern.

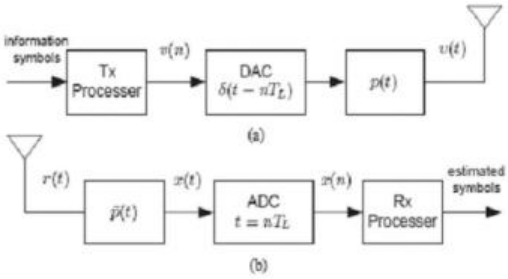

Fig-2: Low complexity node Transmitter and Receiver diagram

E. Speaker

The unit of measure the impedance is ohm. Typically speakers have 4ohms, 8ohms or 16ohms. The ohm value of the speaker indicates how much energy it takes to drive it. The higher the ohms rating the more difficult to drive it. The impedance of a speaker is a physical property that (ideally) does not change value; there are many complex characteristics that make up speaker impedance. For this reason, the rating of a speaker is called its 'nominal' value, for the average audio user, we used the nominal value 8 ohms to alert whenever notification arrives.

F. VB Tool

In the proposed paper we used VB for storing large amount of data. The controller gets any information by using VB whenever needed. The data will be in the form of students list, diagrams or the message received.

G. Touch Panel

Touch is one of the simplest, most instinctive, and universal human actions. There are several reasons to use touch technologies, which include limiting an end-user's access to a computer .Touch technologies allow both of these applications to be retrofitted to computers utilizing one of several technologies currently available. The user point to what they want. Here we are using Resistive Touch which is the most widely used touch technology today. A resistive touch screen monitor is composed of a glass panel and a film screen, each covered with a thin metallic layer, separated by a narrow gap. When a user touches the screen, the two metallic layers make contact, resulting in electrical flow. The point of contact is detected by this change in voltage.

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Advantages of using resistive touch screen:

- It can be activated with virtually any object (finger, stylus, gloved hand, pen, etc.
- It has tactile feel
- Lowest cost touch technology
- Low power consumption
- Resistant to surface contaminants and liquids (dust, oil, grease, moisture)

H. Timer

Computer systems usually have at least one hardware timer. These are typically digital counters that either increment or decrement at a fixed frequency which is often configurable, and which interrupt the processor when reaching zero. An alternative design uses a counter with a sufficiently large word size that it will not reach its overflow limit before the end of life of the system. Here timer is used for the purpose of setting time when long message need to be displayed.

III. MODULES

A. Micro Controller Module

In this module the controller is interfaced with LCDs, graphical display and timer. The message for this unit comes from authorized user through UWB technology.

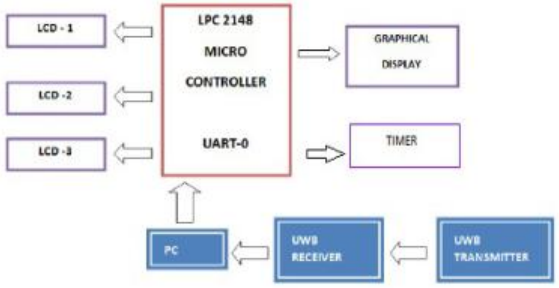

Fig-3: Micro controller block diagram

B. Speaker Module

This module consists of the speaker and a real clock time. The speaker is used to announce the arrival of new message. An interrupt is generated every time a message is received and a pre-recorded message is announced. A clock within the PC records the time of message arrived.

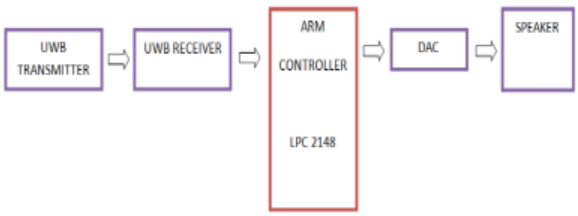

Fig-4.Speaker module block diagram

IV.WORKING PROCEDURE

Initially authorized user will send the message containing to choose the desired LCD. Access will be allowed to the user who is aware of password, implemented for security purpose. Once the message is received it is stored in the computer. Then it checks the LCD number in which the message is to be displayed. The real clock time records the time of message arrived. Graphical LCD displays the message on the concerned LCD. At the same time speaker alert with the pre-recorded message. When there is high-priority message is arrived the interrupt held up the message currently displayed and display the new high prioritized message. The audio recorder will announce the arrival of new messages. The timer within the controller initiates its process whenever new message is arrived.

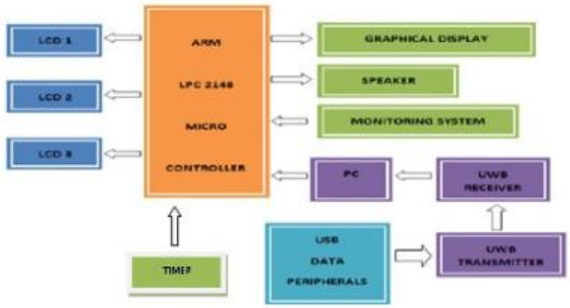

Fig-5: Display based wireless notice board

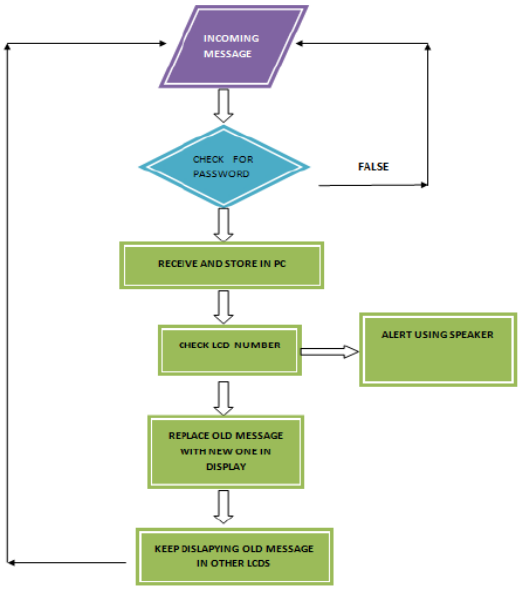

Fig-6: Flow chart

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V.ADVANTAGES OF USING UWB TECHNOLOGY

A. Large Channel Capacity

One of the major advantages of the large bandwidth for UWB pulses is improved channel capacity. *Channel capacity*, or data rate, is defined as the maximum amount of data that can be transmitted per second over a communications channel. The large channel capacity of UWB communications systems is evident from Hartley-Shannon's capacity formula:

Equation 1-5

$$C = B\log_2(1+SNR)$$

Where *C* represents the maximum channel capacity, *B* is the bandwidth, and SNR is the signal-to-noise power ratio. As shown in Equation 1-5, channel capacity *C* linearly increases with bandwidth *B*. Therefore, having several gigahertz of bandwidth available for UWB signals, a data rate of gigabits per second (Gbps) can be expected. However, due to the FCC's current power limitation on UWB transmissions, such a high data rate is available only for short ranges, up to 10 meters. This makes UWB systems perfect candidates for short-range, high-data-rate wireless applications such as wireless personal area networks (WPANs). The trade-off between the range and the data rate makes UWB technology ideal for a wide array of applications in military, civil, and commercial sectors.

B.Resistance to Jamming

Unlike the well-defined narrowband frequency spectrum, the UWB spectrum covers a vast range of frequencies from near DC to several gigahertzes and offers high processing gain for UWB signals. Processing gain (PG) is a measure of a radio system's resistance to jamming and is defined as the ratio of the RF bandwidth to the information bandwidth of a signal

Equation 1-6

$$PG = \frac{RF\ Bandwidth}{Information\ Bandwidth}$$

The frequency diversity caused by high processing gain makes UWB signals relatively resistant to intentional and unintentional jamming, because no jammer can jam every frequency in the UWB spectrum at once. Therefore, if some of the frequencies are jammed, there is still a large range of frequencies that remains untouched. However, this resistance to jamming is only in comparison to narrowband and wideband systems. Hence, the performance of a UWB communications system can still be degraded, depending on its modulation scheme, by strong narrowband interference from traditional radio transmitters coexisting in the UWB receiver's frequency band [2, 4, 5].

C.Ability to Work with Low Signal-to-Noise Ratios

The Hartley-Shannon formula for maximum capacity (Equation 1-5) also indicates that the channel capacity is only logarithmically dependent on signal-to-noise ratio (SNR). Therefore, UWB communications systems are capable of working in harsh communication channels with low SNRs and still offer a large channel capacity as a result of their large bandwidth.

D. Low Probability of Intercept and Detection

Because of their low average transmission power, as discussed in previous sections, UWB communications systems have an inherent immunity to detection and intercept. With such low transmission power, the eavesdropper has to be very close to the transmitter (about 1 meter) to be able to detect the transmitted information. In addition, UWB pulses are time modulated with codes unique to each transmitter/receiver pair. The time modulation of extremely narrow pulses adds more security to UWB transmission, because detecting picoseconds pulses without knowing when they will arrive is next to impossible. Therefore, UWB systems hold significant promise of achieving highly secure, low probability of intercept and detection (LPI/D) communications that is a critical need for military operations.

TABLE1 ADVANTAGES AND BENEFITS OF UWB TECHNOLOGY

Advantage	Benefit
Coexistence with current narrowband and wideband radio services	Avoids expensive licensing fees
Large channel capacity	High bandwidth can support real-time high-definition video streaming
Ability to work with low SNRs	Offers high performance in noisy environments
Low transmit power	Provides high degree of security with low probability of detection and intercept
Resistance to jamming	Reliable in hostile environments.
High performance in multipath channels	Delivers higher signal strengths in adverse conditions
Simple transceiver architecture	Enables ultra-low power, smaller form factor, and better mean time between failures, all at a reduced cost

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V. CONCLUSION

The results were satisfactory about all implementation part. The message from data peripherals was successfully transmitted through USB UWB transmitter. The data received at UWB receiver was accurate and sent for further effective processing. Timer helps to display the duration of message. In order to use ARM controller in full effectiveness, much more development can be brought about such as the addition of a monitoring system which make use of the other UART.

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