# Design Telemetry Monitoring System

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**Abstract-** Network controlled device has its own demand and application with fast development in technology. The proposed paper is design to add security issue to any general premises. In this paper, telemetry monitoring based on embedded system and Ethernet technology proposed. Method of embedded system interface based on Ethernet and ARM7LPC2378 processor. The platform itself has Ethernet interface on it DP83848H can directly connect with the Ethernet MAC, to develop system. A data can be transmitted transparently through Ethernet interface unit to the remote end desktop computer. This design has the advantage of cost-effective, easily realized, stable and reliable transmission and so on.

**Keywords:** Embedded Ethernet; ARM; PIR sensor.

## 1. INTRODUCTION

In a network controlled embedded systems, each system can communicate with the other systems in the network, sharing information and sending and responding to requests as needed. Desktop computers in the network can monitor and control the operation of the embedded systems. Many local networks follow the networking standard popularly known as Ethernet. Ethernet networks are capable and flexible. Many products designed for use in networks have support for Ethernet built in. All computer networks have some things in common. Every network must have the physical components that enable the computers in the network to exchange data [5]. All networks include the following physical components:

Two or more computers that need to communicate with each other. In the networks, at least one of the computers is an embedded system, which is a device that contains a computer dedicated to a specific task or a series of related tasks. A defined physical interface, to ensure that the output of a transmitting computer is compatible with the inputs of the receiving computers [1]. For Ethernet networks, the Ethernet standard specifies this interface. Cables or wireless transceivers to connect the computers. Ethernet networks have several options for cables. An Ethernet interface may also connect to a device called a wireless access point, which enables the embedded system to access a wireless network.. The Ethernet access to embedded systems usually has two kinds of method:

1. The embedded processor of integrated Ethernet interface. The former requires embedded processor has general network interface, usually it was designed for network application and embed the curing network protocol in internal, processor and network rapidly exchange data through the internal bus.
2. Embedded processor is used with Ethernet controller chip. These types has not special requirements and only connect the Ethernet control chip to the processor bus, but processors and network exchange data through the external bus (usually a parallel bus), it will slow network speed and the reliability is not high [2]. Here processor of integrated Ethernet interface chosen. In the system the data captured through PIR & REED sensor will be transmitted transparently between host and serial device and the host can communicate with any serial device connected Ethernet without knowing each other's physical location. ARM 7 LPC2378 development kit with DP83848H module, are connected using a crossover Ethernet cable RJ 45. On the transmission side, user-entered data is compiled into an IEEE 802.3 frame; on the reception side, data is extracted from the frame and displayed through the network analyzer.

## 2. SYSTEM HARDWARE DESIGN

The system mainly composed of Processor module is the core part of the design, in which the ARM chip LPC2378 used shown in Figure 1. LPC2378 is an ARM-based microcontroller for applications requiring serial communications for a variety of purposes [9]. These microcontrollers incorporate a 10/100 Ethernet MAC(DP83848H), USB 2.0 Full Speed interface, four UARTs, two CAN channels, an SPI interface, two Synchronous Serial Ports (SSP), three I²C interfaces, an I²S

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interface, and a Minibus (LPC2378 only: 8-bit data/16-bit address parallel bus).

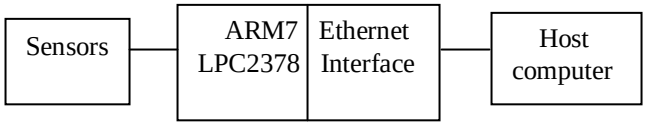


Figure 1. System Block Diagram

In the LPC2378 board have in built Ethernet interface module is provided and the collected data are uploaded to a PC via Ethernet interface as shown in Figure 2.In the Ethernet interface module, Ethernet controller DP83848H (PHYTER mini extended temperature qualified to AEC-Q100 grade 2) are divided into two layers according to its functions .One is media access controller (MAC) layer and the other is network physical (PHY) layer. They correspond to Layer 2 and Layer 1 in ISO model [8]. MAC layer provides the treatment on data sending and receiving. It also provides an interface to PHY through an internal medium independent interface.

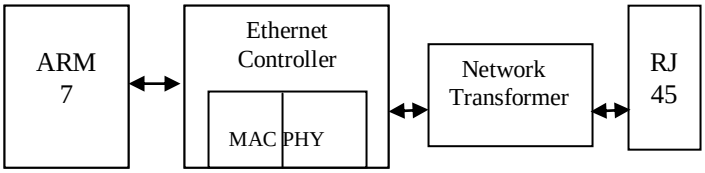


Figure 2. Ethernet controller and Ethernet interface

In this design, LPC2378 supports Ethernet interface and network transformer HR601680 which is connected between Microcontroller Lpc2368 and connector RJ45 is used to improve the signal anti-interference capability. HR601680 is a 1:1 transformer with a smaller package and it supports 10M/100M Ethernet [10]. For the purpose of testing, the microcontroller is used to control a Lamp and monitor a Passive Infra Red (PIR) sensor for motion detection & REED switch as a Door opening Sensor .The PIR (Passive Infra-Red) Sensor is a pyroelectric device that detects motion by measuring changes in the infra-red levels emitted by surrounding objects. This motion can be detected by checking for a high signal on a single I/O pin, in the current development. Here #555-28027 PIR sensor manufactured by Parallax is used [11]. The ORD213 is a small single-contact reed switch designed for general control of low-level loads less than 24 V. The reed contacts are sealed within the glass tube within inert gas to maintain contact reliability. With a permanent magnet installed, reed switches economically and easily become proximity switches [12].

## 3. SYSTEM SOFTWARE DESIGN

In the design of network communication, we should handle Ethernet frame accepting and Ethernet frame transmitting, According to the received packet type, choose a different approach; the length of frame cannot exceed the IEEE802. 3 standards (1 514 bytes) in accepting, when transmit Ethernet frame, we should add 14 bit Ethernet header logo on the transmission data, namely, increase the packet length [3].
Data transmission over the Ethernet medium can be segmented into three main steps:

1. Initialization of the EMAC, PHY and the CPU:
   (a) Initialize EMAC Control Registers.
   (b) Initialize PHY registers.
   (c) Enable interrupts after setting interrupt handlers for the EMAC interrupts.
2. Transmission of frame:
   (a) Generate fields within the frame.
   (b) Generate an Ethernet packet with the help of the frame.
   (c) Create a descriptor table for the Ethernet packet.
   (d) Transfer control of the buffer to EMAC for transmission.
   (e) Once the packet is transmitted interrupt occurs and the program is looped back to initial starting point.
3. Reception of frame:
   (a) Check the status of reception.
   (b) Copy data into memory location specified by the user.
   (c) Update the EMAC Interrupt Status .Register and loop to initial starting point.

## 4. SYSTEM TESTING

After the software and hardware designs have been completed, the ultimate generated codes are compiled and downloaded to the target system for testing. SPJ's LPC2378 Target board and SCARM compiler used. **SCARM** is SPJ Systems' C Compiler for ARM [9]. It also includes an IDE and other tools like Visual Code Generator (VCG) and terminal emulation utility (SPJTerm). A network packet analyzer will try to capture network packets and tries to display that packet data as detailed as possible. Wireshark a network packet analyzer is used.

## 5. RESULT

Figure 3 indicates the monitoring interface of captured data; from it we know the system can fulfill the design requirements. The send data are control commands sent from monitor computer to equipment while the receive data are state feedback data received from equipment. The number of bytes in wire (RJ45) match to captured one.

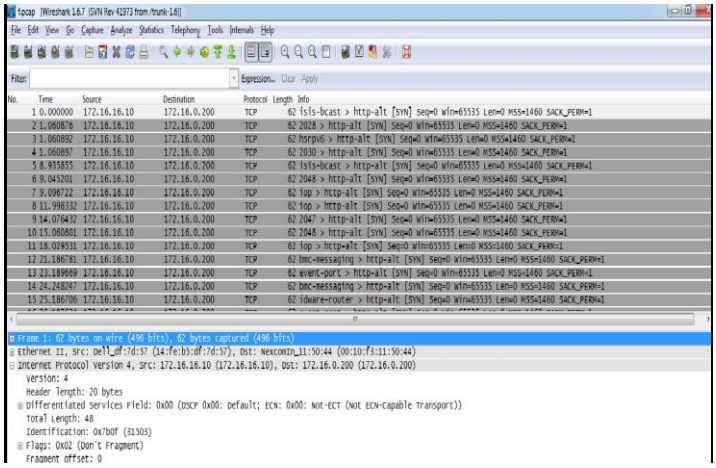

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Figure 3. Wireshark Network Protocol Analyzer decodes and displays Ethernet traffic.

## 6. CONCLUSION

Through the analysis of above-mentioned test result, system developed will be very useful to increase security against the theft. While the Ethernet is most mature and widely used data link layer technology for Internet, the scheme proposed in this project not only can be used in connecting the embedded device to LAN, but also as a data link and physical layer support for embedded web system. This system can be used widely in the domain of data-acquisition and remote data transportation. The system can be used in access control, security, attendance system and industrial on-site network monitoring etc.

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