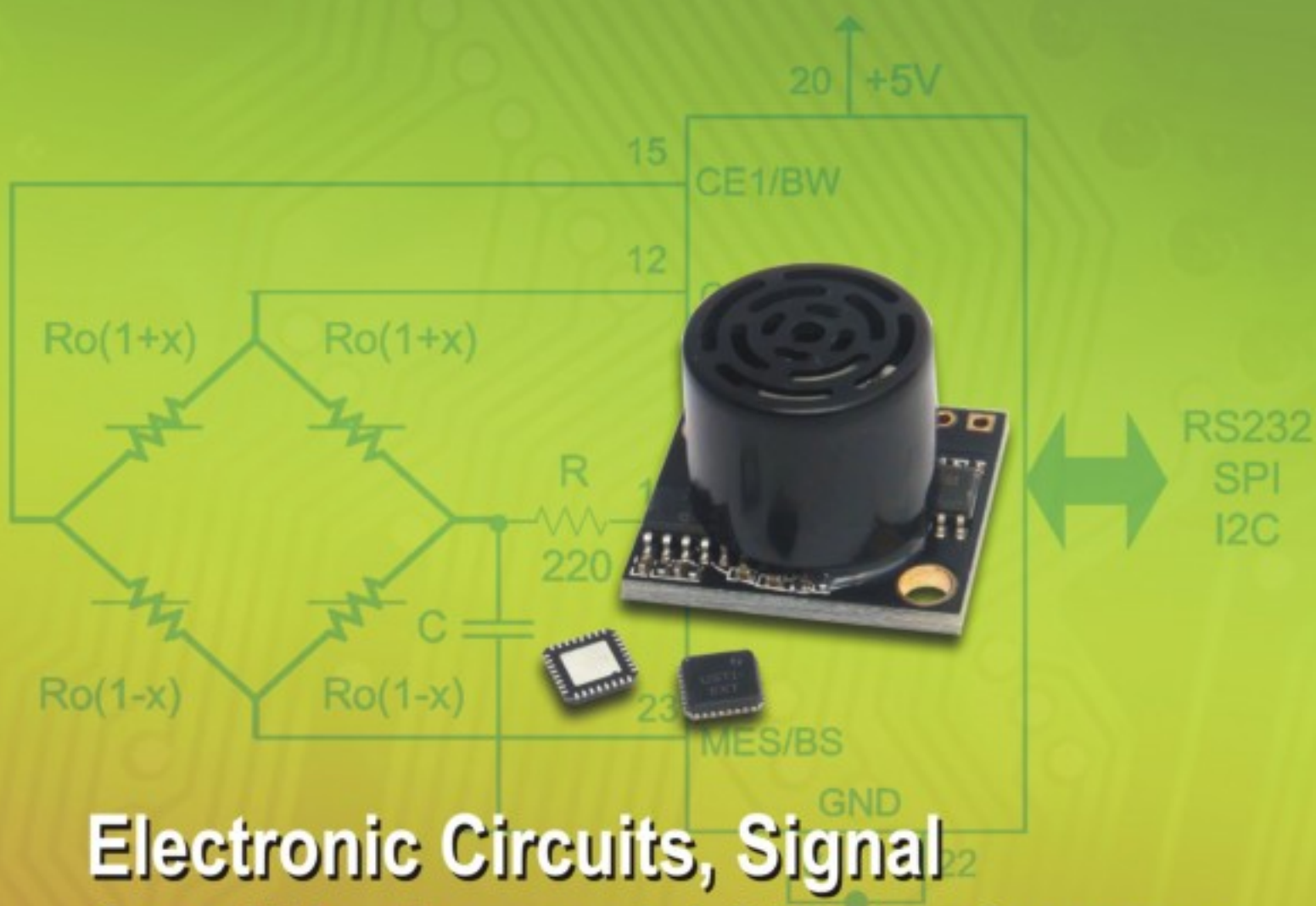


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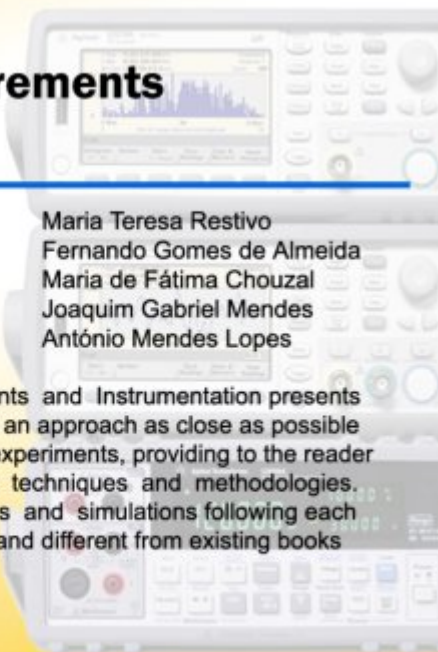
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ARM Processor Based Embedded System for Examination Question Paper Leakage Protection System

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Abstract: Question paper leakage is one of the main issues for the students, who suffer from the postponement or cancellation of examination. The compact solution for this problem is ARM processor based examination paper leakage protection system. The question paper comes to the college in an electronic sealed box called ibox. The ibox contains an embedded system that was designed using ARM processor, which contains inbuilt RTC to monitor the ibox. If anyone tries to open the ibox before and after the RFID (Radio Frequency Identification) swipe time duration, the system reports to university authorities by sending an SMS (Short Message Service) through GSM (Global System for Mobile communication) that “some malfunctioning is happening with the ibox”. Before 10 minutes of exam the university authorities sends a unique pass code to the chief examiner of the college. The chief examiner has a valid RFID card from the university and swipes the card. If the card is valid the system acknowledges for the pass code. Chief examiner needs to type the pass code using keyboard. If pass code is correct stepper motor rotates and unlocks the ibox. The system is having two sections of transceivers (A and B). The transceiver A is an embedded system associated with the ibox. The transceiver B is the mobile phone with the university authorities. The present work deals with the software and hardware part. *Copyright © 2012 IFSA.*

Keywords: ARM Processor, GSM, SMS, RFID, Embedded System.

1. Introduction

An embedded system is a combination of software and hardware which is designed for one specific application in a time domain constraint. Now-a-days the meaning of the embedded system was changed because, it was not designed only for one specific application but, many applications can run with a single embedded system. The best example of an embedded system is a mobile phone which performs the communication, along with the communication one can surf the internet, access the social network sites, play the games and even global positioning system is deployed into such a small device.

Until a few years ago, general-purpose processors and computers have been the driving force in shaping the digital economy. A general purpose processor is a microprocessor which incorporates the functions of a computer's central processing unit on a single integrated circuit. Technically speaking microprocessors need more hardware to interface and to interact with the other peripheral devices. Microprocessors do not have I/O lines, on-chip memory, timers, counters etc... next the 8-bit microcontrollers are designed with all mentioned peripherals was integrated into a single chip. These 8-bit microcontrollers are designed for both parallel and serial communication purpose. Then lot of microcontrollers are designed which categorizes like 8-bit, 16-bit and 32-bit microcontrollers.

There are many reasons, both technical and market driven to select one processor over another. In a lot of embedded-type applications the device encompasses functionality other than simply high speed data processing, such as a user interface, communications, or mechanical device control. The present work can be carried out by using 8-bit microcontroller but more hardware is required in the form of external peripherals and connecting them to work as an embedded system.

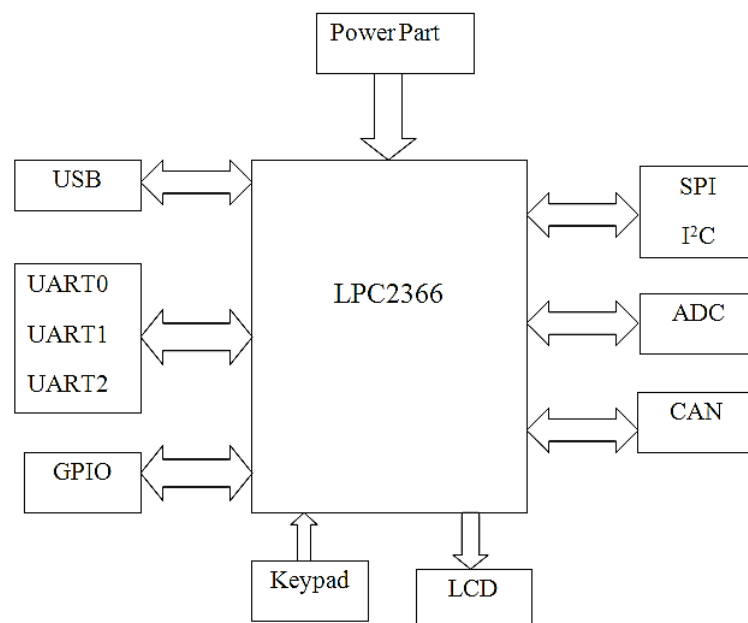


Fig. 1. Block Diagram of LPC2366 Development Board.

The ARM architecture is the most widely used 32-bit instruction set architecture microcontroller. Many chips with ARM processors include peripherals A/D converters, counter/timers, capacitive touch controllers, LCD controllers, USB, Wi-Fi baseband, etc. They already built into the chip, a way to disable peripherals when they are not being used, saving power without having to add extra power management components. The wider variety of ARM processors means that, it is likely to find one,

which includes the functionality that needs for the device already built-in to the chip rather than having to add a second chip for that function. This saves on peripheral cost, design time, and physical space on the circuit board. Despite the variety in peripherals, the internal processor itself remains mostly the same across the variations, still allowing for economy of scale for development tools, and a large enough community of developers to find peer support for technical questions.

During the time of examination, students get depressed of finding the news in the television or newspaper about question paper leakage and hence the exam was postponed / cancelled. In order to prevent this question paper leakage, a compact and portable solution was designed using advanced RISC machine. ARM processor based microcontroller used in the present study is LPC2366, which is Low Power Consumption controller from NXP Phillips. LPC2366 has in built 10 bit ADC, 3 UARTs, 70 GPIOs, 10 bit DAC, 4 timers/ counters, RTC, watch dog timer (WDT), etc. Using these in built peripherals the designing of paper leakage protection system achieves its portability. Other peripherals like GSM modem, RFID module, keypad, LCD and stepper motor are used in this system.

2. Hardware Description

Designing of hardware is an essential part to implement any embedded system. In the present work hardware peripherals LPC2366, RFID (Radio Frequency Identification) module, GSM (Global System for Mobile Communication) module, Keypad and stepper motor are used.

Fig. 1 shows the block diagram of the LPC2366 development board. The development board contains power part, USB (Universal Serial Bus) port, 3 UARTs (Universal Asynchronous Receiver and Transmitter), GPIOs (General Purpose Input Output), 4X4 Hex Keypad, LCD (Liquid Crystal Display), 2 CAN (Controller Area Network) ports, ADC (Analog to Digital Converter) connector, etc. Power part provides power supply to the board from a 12 V adapter.

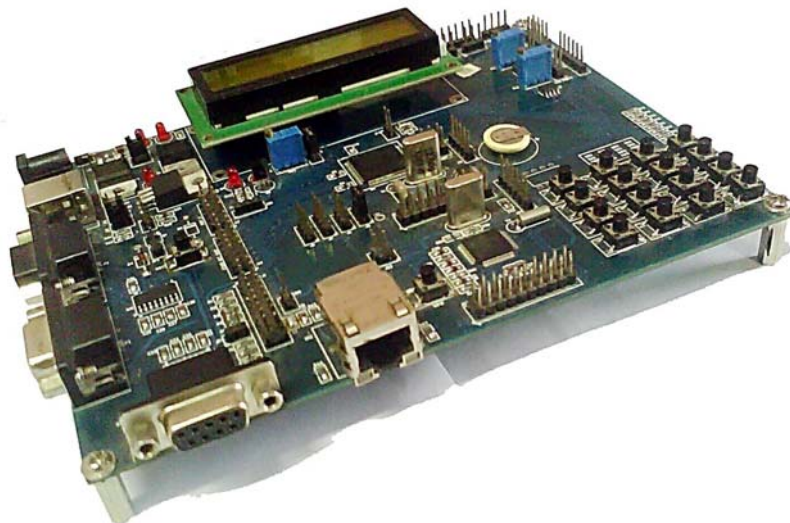


Fig. 2. LPC2366 ARM Development Board.

The power part regulates the 12 V power supply to 3.3 V by using the regulator ICs 7805 and LM1117T. In order to provide power supply to the board one can use the USB port also. Three UARTs namely UART0, UART1 and UART2 is used to make serial communication with the outside world. In the present work UART0 is used to dump the hex file from PC to microcontroller and after that, it is

connected to the RFID module. UART1 is connected to the GSM module. UART2 is left unused. LPC2366 have 70 GPIOs in which 7 lines are used to interface with LCD, 8 lines are used to interface with keypad and 4 lines are used to interface with the driver circuit of stepper motor. SPI, I²C, ADC and CAN are left unused.

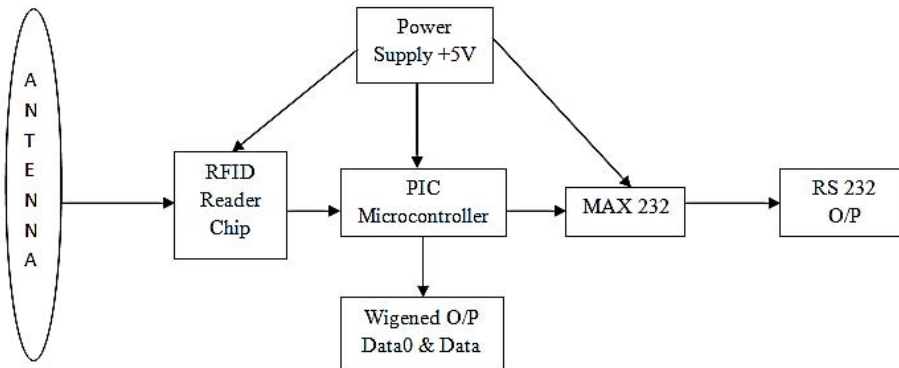


Fig. 3. Block Diagram of RFID Reader.

Fig. 3 shows the block diagram of RFID Reader. There are two main components used by the RFID module: The Interrogator (RFID Reader) which transmits and receives the signal and the Transponder (tag) that is attached to the object. Communication between the RFID Reader and tag occurs wirelessly and generally does not require a line of sight between the devices. The RFID Reader emits a low-power radio wave field which is used to power up the tag so as to pass on any information that is contained on the chip.

- Antenna generates 125KHZ frequency which is used to read the data in RFID tag.
- RFID Reader reads the data present in RFID tag.
- PIC Microcontroller decodes the data into Serial output and wig end output.
- MAX232 is used to convert signal from TTL to RS232.

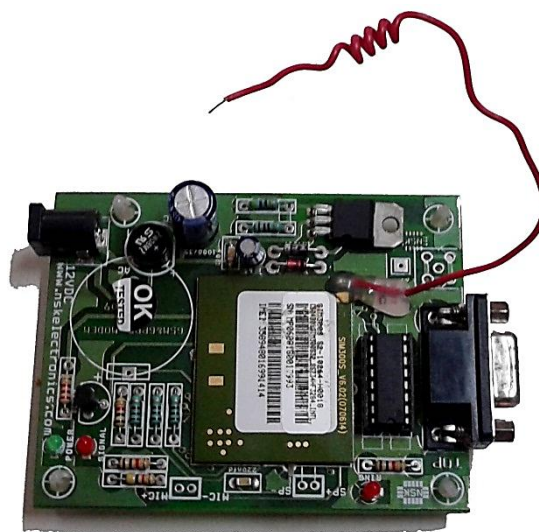


Fig. 4. GSM Modem Module.

The GSM modem used by cell phones that provides low cost, long range, wireless communication channel for applications that need connectivity rather than high data rates. The interface between GSM and ARM controller is a textual protocol called Hayes AT- Commands. This particular application connects an ARM controller and Siemens M65 cellular phone using a RS232 based data cable. Fig. 4 shows the photograph of GSM modem module.

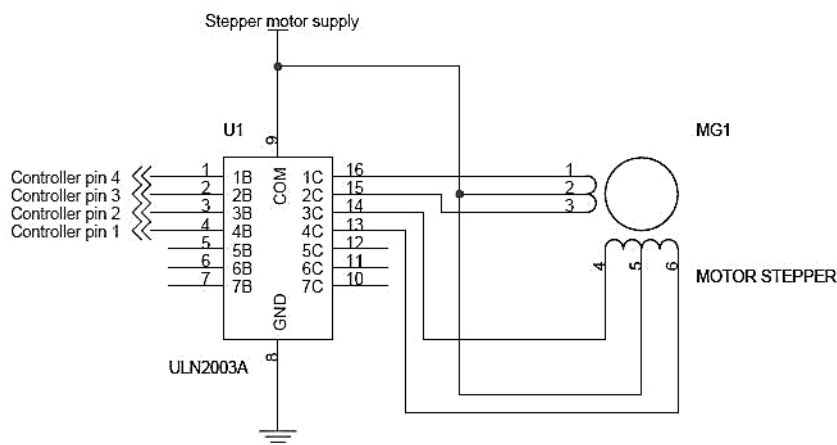


Fig. 5. Schematic Diagram of ULN2003A and Stepper Motor.

Fig. 5 shows the circuit diagram of interfacing of controller and stepper motor through ULN2003A. In the present study the stepper motor was used as the locking mechanism. A lock mechanism including a lock lever movable between unlocked and locked positions, the lock lever being connected to further components of the lock mechanism to provide for corresponding unlocked and locked conditions of the lock mechanism, the lock lever being operably movable between the unlocked and locked positions by a stepper motor and through a drive path by a automatically actuatable element. The drive path includes ULN2003A and connected to the stepper motor as shown in Fig. 5. LPC2366 pins P0.4 (controller pin1) through P0.7 (controller pin4) was connected to ULN2003A.

3. System Functionality

The system consists of two transceiver sections, transceiver A and transceiver B. Fig. 6 shows the block diagram of transceiver A i.e. ARM processor based embedded system for question paper leakage protection system and transceiver B is a mobile with the university authorities. Transceiver A consists of LPC2366 which was interfaced with Keypad, GSM, LCD, stepper motor and RFID modules.

The RFID and GSM modules are connected to the UART0 and UART1 respectively. The LPC2366 port pins P0.2 (TX0) and P0.3 (RX0) are connected to pin11 and pin12 of MAX232 to made UART0 work for code firing. The LPC2366 port pins P0.15 (TX1) and P0.16 (RX1) are connected to pin10 and pin9 of MAX232 16 pin IC to made UART1 work. In the present work LCD was connected and programmed to 4 data lines (D0 – D4) of LPC2366 i.e. P1.24 through P1.29. Keypad was connected to the port lines P2.0 through P2.7, and Stepper motor driver ULN2003A was connected to the port lines P0.4 through P0.7 of LPC2366.

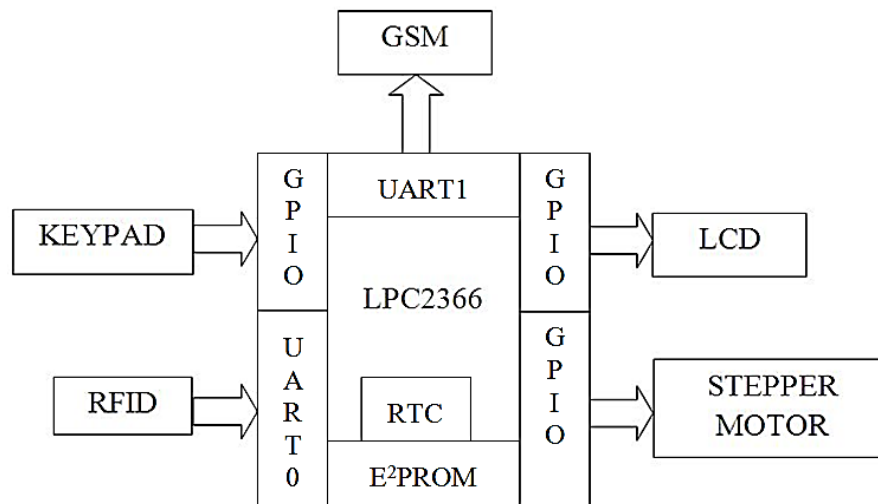


Fig. 6. Block Diagram of ARM Processor Based Question Paper Leakage Protection System.

The system was programmed in “Embedded C” language. The software flow chart was shown in the Fig. 7. A unique GSM pass code from the university authorities was sent to the chief examiner of the college. GPIO’s, UART0, UART1, RTC and E²PROM’s were initialized. At power on, LCD, GSM initializes and displays "EXAM PAPER LEAK PROTECTION". The RTC of LPC2366 was programmed in such a way to run the present local time and it is displayed on the LCD. The E²PROM was stored with RFID tag address “20747628”, GSM pass code “B2389”, examination date and time of the examination. 10 min duration was kept within which the operation must complete. Let us assume that the card swipe time duration was loaded as 9am to 9:10am. If the RFID card swipes before 9am then “INVALID TIME” displays on the LCD and the system sends a message to the predefined mobile number of university authorities. The card was swiped between 9am and 9:10am which is a valid time and “VALID CARD” displays on LCD. After swiping the card the unique pass code should enter through the keypad of the system. If the RFID tag address and GSM pass code which is entered and that stored on E²PROM matches, then the stepper motor rotates to open the ibox. Hence, the question papers are safe from theft before examination. If the card is swiped before 9am or after 9.10am it will be invalid.

4. Results

The photograph of the present work was shown in Fig. 8. The design and implementation of ARM processor based examination question paper leakage system was effectively carried out with the advantages of low cost, low power consumption, high portability and minimum peripheral interfaces. The system was tested with the RFID card swipe time duration from 9am to 9:10am. The response of the system is good and successfully tested all the conditions mentioned in the system functionality. Test conditions include:

1. Invalid RFID card swiped and the system was not responded and displayed the message “INVALID CARD” on LCD.
2. RFID card was valid and GSM pass code was wrong then system displayed “PASS CODE ERROR” and message was sent to +91-9160425798.
3. Both RFID and GSM pass code were valid; the system granted access and stepper motor rotated (to open the ibox).
4. When RFID card was swiped before 9am and after 9:10am the system displayed “UNAUTHORIZED ACCESS” and message was sent to +91-9160425798.

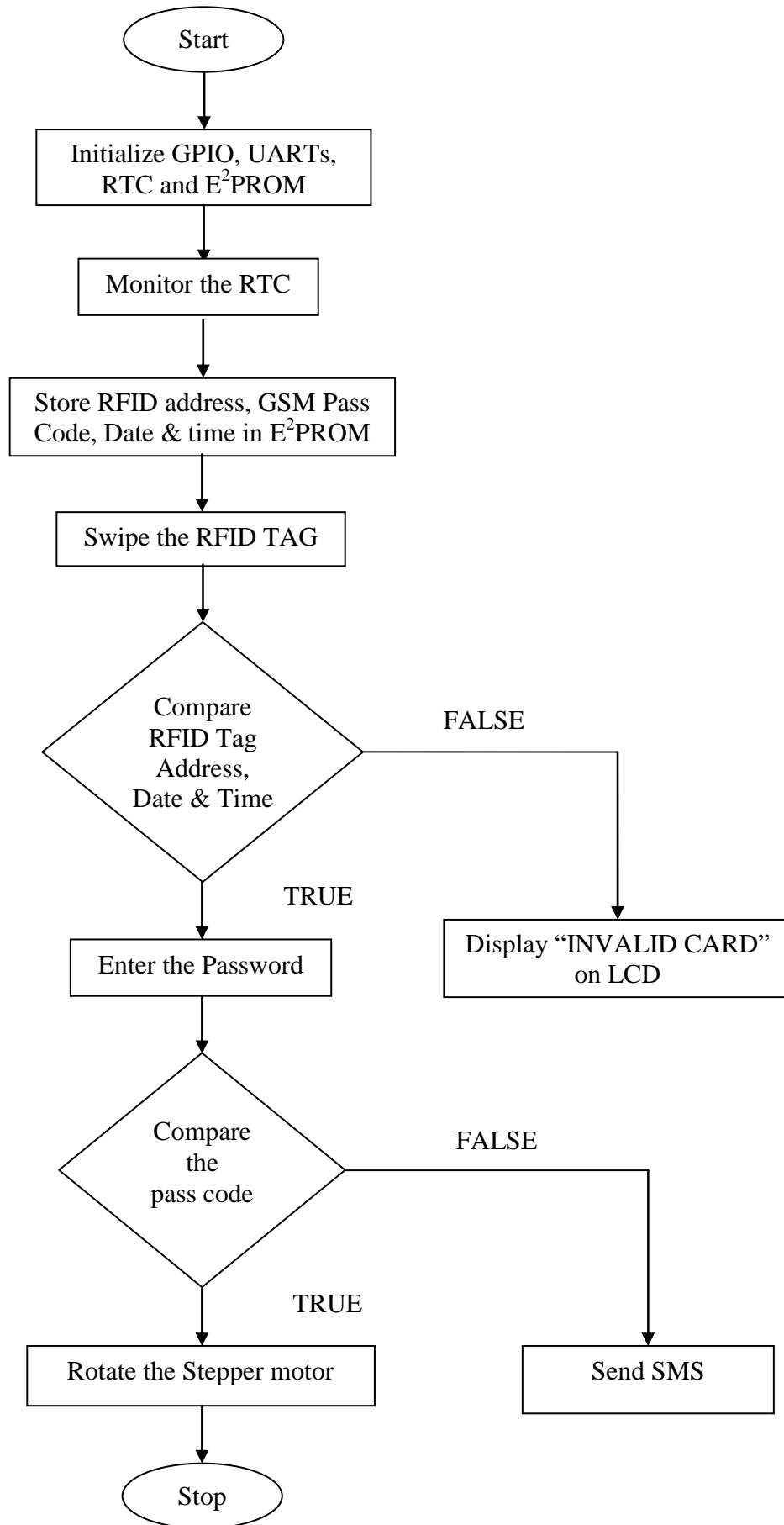


Fig. 7. Flow Chart of the Software.

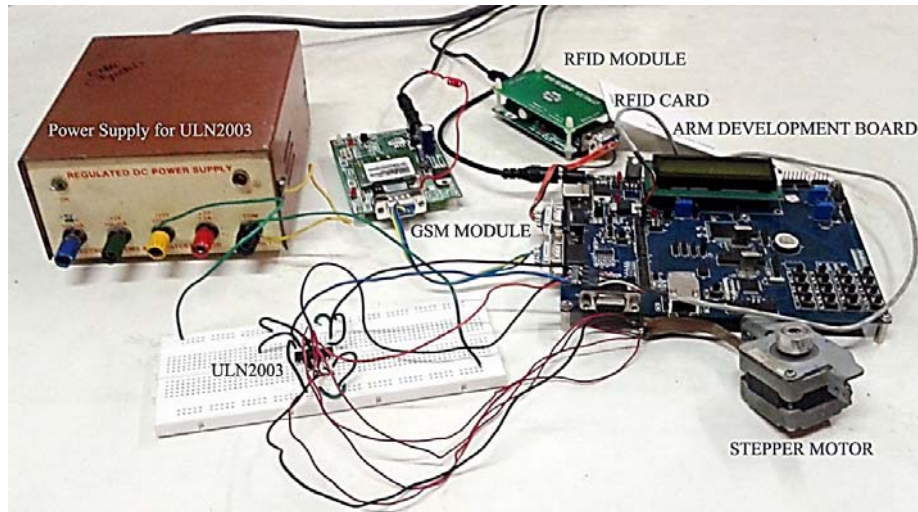


Fig. 8. Photograph of ARM Processor Based Question Paper Leakage Protection System.

5. Conclusions

The compact solution for the examination paper leakage was achieved with ARM based embedded controller. The present work can be extended to protect the answer sheets to send it to the university authorities. The embedded system can be programmed to close the ibox after the completion of the exam.

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References

- [1]. Muhammad Ali Mazidi, Janice Gillespie Mazidi and Rolin D. McKinlay , The 8051 Microcontroller and Embedded Systems using Assembly and C, 2nd Edition, *PHI*.
- [2]. David Seal, ARM Architecture Reference Manual, 2nd Edition, *Addison Wesley*.
- [3]. Andrew N. Sloss, Dominic Symes, Chris Wright, ARM System Developer's Guide: Designing and Optimizing System Software, 2nd Edition, *Elsevier*.
- [4]. C. Nagaraja, C. Chandra Mouli, S. Athavulla, and T. Bheemalingaiah, A Microcontroller Based Programmable Power Supply, *Lab Experiments – A Journal of Laboratory Experiments*, Vol. 10, No. 4, December 2010, pp. 249-253.
- [5]. C. Chandra Mouli, V. Ramnath, D. Sailaja, and K. Nagabhushan Raju, Embedded System Based Exhaust Fan Control, *Lab Experiments – A Journal of Laboratory Experiments*, Vol. 11, No. 3, September 2011, pp. 200-201.
- [6]. LPC2366 data sheet (http://docweb.khk.be/Patrick%20Colleman/ARM7/lpc236x_ds.pdf).
- [7]. LPC2366 User Manual (http://www.keil.com/dd/docs/datashts/philips/lpc23xx_um.pdf).
- [8]. Pentagram Technologies (<http://www.pentagramtechnologies.com/m13s2.html>).

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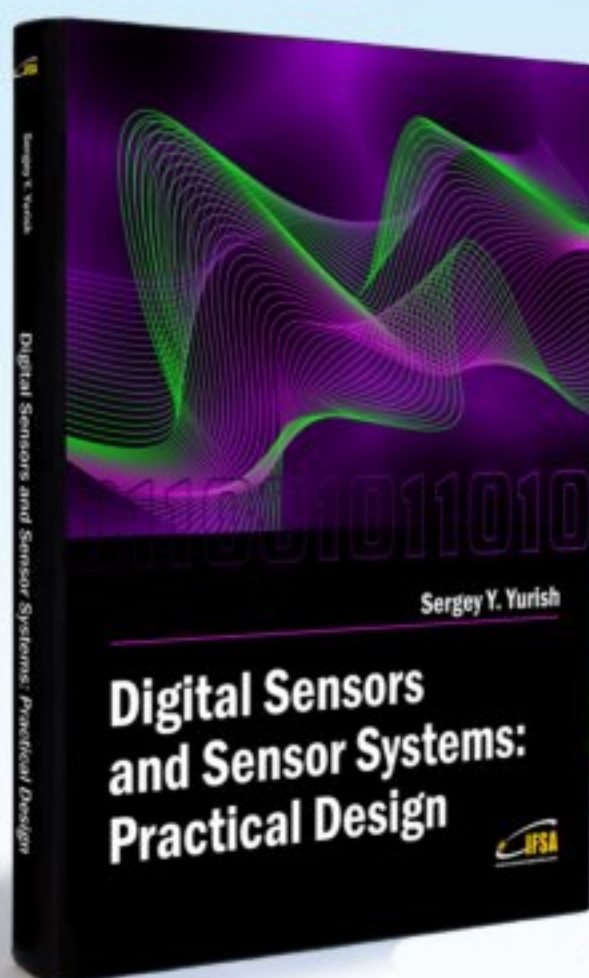
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