KARNATAKA LAW SOCIETY'S

GOGTE INSTITUTE OF TECHNOLOGY

Department of Computer Science and Engineering

Udyambag, Belagavi – 590008

(An Autonomous Institution under Visvesvaraya Technological University, Belagavi)

(APPROVED BY AICTE, NEW DELHI)

A Course Project Report on

"Implementation of Switch-Based Counting and Serial Communication using UART in an Embedded System"

Submitted for the academic requirements of 6th semester B.E.in CSE for

"Embedded Systems and Internet of Things (18CS63)"

Submitted by

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DEPARTMENT OF COMPUTER SCIENCE and ENGINEERING

CERTIFICATE

This is to certify that the Course Project work titled "Implementation of Switch-Based Counting and Serial Communication using UART in an Embedded System" carried out by SHRADHA PATIL, SRUSHTI MUDENNAVAR AND YASH HEREKAR bearing **2GI20CS144, 2GI20CS158, 2GI20CS184** have submitted in partial fulfilment of the requirements for 5th semester B.E. in**,** Visvesvaraya Technological University, Belagavi. It is certified that all corrections/suggestions indicated have been incorporated in the Report. The report has been approved as it satisfies the academic requirements in respect ofresearch work prescribed for the said degree.

Dr. Sharada Kori

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Marks allocation: (Page 2)

	Batch No.:13				
1.	Seminar/Project Title:	Marks Range	USN/Roll No		
			144	158	184
2.	Abstract (PO2)	0-2			
3.	Application of the topic to the course (PO2)	0-3			
4.	Literature survey and its findings (PO2)	0-4			
5.	Methodology, Results and Conclusion (PO1,PO3,PO4)	0-6			
6.	Report and Oral presentation skill (PO9, PO10)	0-5			
	Total	20			

*** 20 marks is converted to 5 marks for CGPA calculation**

1.Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

2.Problem Analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and Engineering sciences.

3.Design/Development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4.Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5.Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6.The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7.Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8.Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9.Individual and team work: Function effectively as an individual and as a member or leader in diverse teams, and in multidisciplinary settings.

10.Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological channel

Contents

1.Title: Implementation of Switch-Based Counting and Serial Communication using UART in an Embedded System.

2.Problem Statement: Read the status of switch connected to p1.0. if switch is ‘0’, implement 8 bit even count on p2. if switch is ‘1’ implement 8-bit odd count on p2. send the characters "even " for even count and the characters "odd" for odd count serially UART at 2400 baud, 8-bit data and 1-stop bit.

3.Components used:

1. 8051 Microcontroller:

The 8051 microcontroller serves as the central processing unit for the project. It is responsible for controlling and coordinating the entire system's operation. The microcontroller reads the status of the switch, performs the count on the output port, and manages the UART communication.

2. UART Module:

The UART (Universal Asynchronous Receiver-Transmitter) module facilitates serial communication with external devices. In this project, the UART module enables the microcontroller to transmit data serially at a specific baud rate, 8-bit data, and 1-stop bit. It is responsible for transmitting the status messages ("EVEN" or "ODD") to a UART terminal or serial monitor for monitoring or further processing.

3. Switch (Connected to P1.0):

The switch is an input component connected to the microcontroller's P1.0 pin. It allows the user to select the mode of operation for the count. If the switch is in the '0' position, the microcontroller performs an even count. If the switch is in the '1' position, the microcontroller performs an odd count.

4. LEDs or Output Device (Connected to P2):

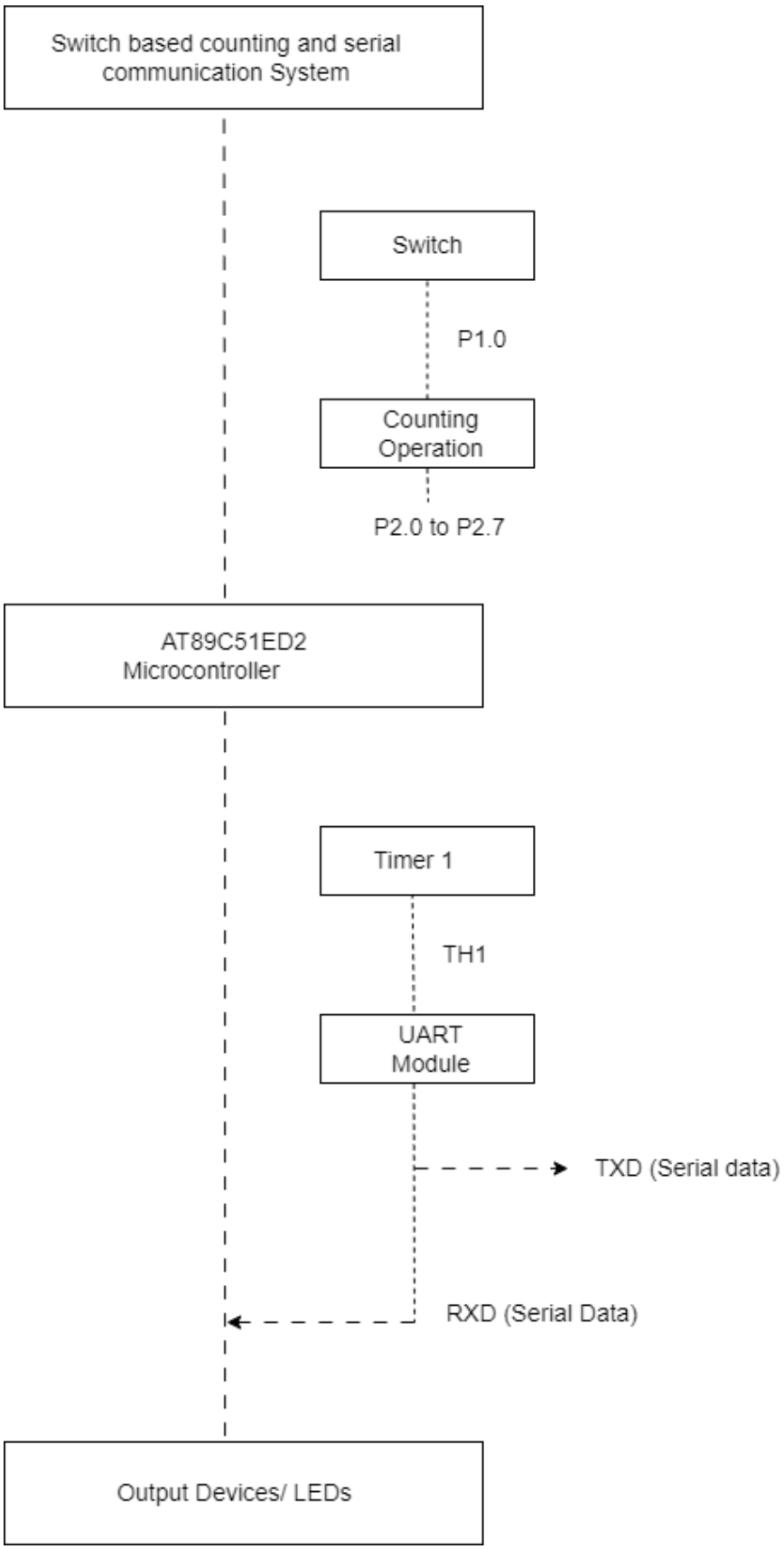
P2 is an output port of the microcontroller, which can be connected to LEDs or any other

output device. In this project, LEDs or similar output devices can be connected to P2 to visually observe the count values. The LEDs will indicate the current count value based on the selected mode (even or odd).

5. UART Terminal or Serial Monitor:

The UART terminal or serial monitor is an external device (such as a computer) that receives and displays the UART communication data. In this project, it is used to receive and display the status messages ("EVEN" or "ODD") transmitted by the microcontroller via UART. This allows for monitoring the count status remotely or integrating the system with other devices.

4.Design/Functional Block Diagram:



5.Manual Calculations:

To calculate the value of TH1 for a baud rate of 2400 in the AT89C51ED2 microcontroller, we need to consider the oscillator frequency and the desired baud rate.

The AT89C51ED2 microcontroller has an on-chip oscillator with a frequency of 11.0592 MHz (11,059,200 Hz). The UART module in the microcontroller uses Timer 1 in Mode 2 for baud rate generation.

The formula to calculate TH1 is as follows:

TH1 = 256 - (Fosc / (32 * N * Baudrate))

Where:
- Fosc is the oscillator frequency
- N is the desired number of machine cycles per bit
- Baudrate is the desired baud rate

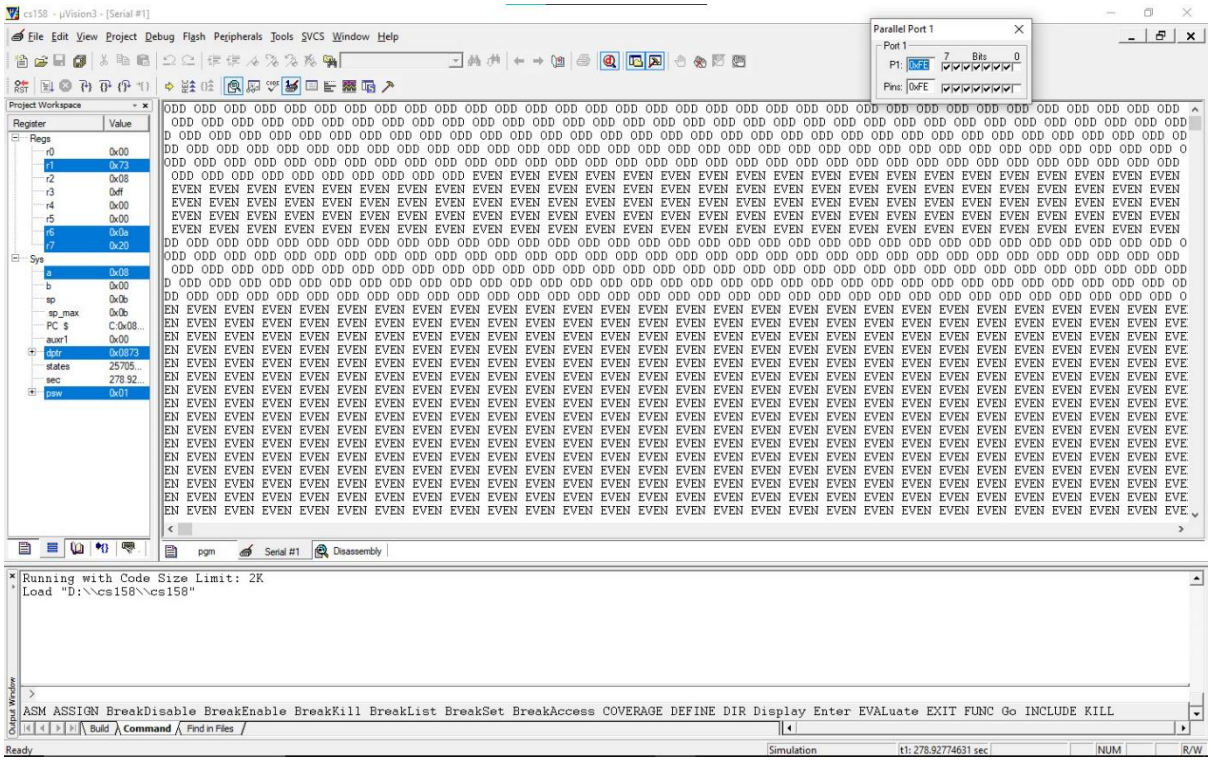
For 8-bit data with no parity and 1 stop bit (8-N-1 format), N is typically 12.

TH1 = 256 - (11,059,200 / (32 * 12 * 2400))
= 256 - (11,059,200 / 921,600)
= 256 - 12

Therefore, TH1 = 244 (decimal) or 0xF4 (hexadecimal).

So, to achieve a baud rate of 2400, the value to be loaded into the TH1 register would be 0xF4 (in hexadecimal) or 244 (in decimal) in the AT89C51ED2 microcontroller.

6.Working Model of the final solution:



7.Working code for mini project:

```
#include "at89c51ed2.h"// Include the header file for 8051
microcontrollers
sbit switchPin=P1^0;

// Function to initialize UART
void UART_Init() {
    TMOD = 0x20; // Set Timer 1 in Mode 2
    SCON = 0x50; // Set UART in Mode 1, 8-bit data, 1-stop bit
    TH1 = 0xF4;// Set Baud rate
    TR1 = 1; // Start Timer 1
}

// Function to transmit a character via UART
void UART_Transmit(char ch)
{
    SBUF = ch;
    while (!TI); // Wait until transmission is complete
```

```
    TI = 0; // Reset transmission flag
}

// Function to transmit a string via UART
void UART_TransmitString(char* str)
{
    while (*str != '\0') {
        UART_Transmit(*str);
        str++;
    }
}

void main()
{
   // unsigned char switchStatus;
    unsigned char count = 0;
    UART_Init(); // Initialize UART
     switchPin=1;  // set P1 as input
     while (1) {
        //switchStatus = switchPin; // Read the status of the
switch connected to P1.0

        if (switchPin == 0) {
            // Implement 8-bit even count on P2
            P2 = count;
            count += 2;
            UART_TransmitString("EVEN ");
        } else {
            // Implement 8-bit odd count on P2
            P2 = count + 1;
            count += 2;
            UART_TransmitString("ODD ");
        }
    }
```

```
}
```

8.Conclusion:

In conclusion, we successfully implemented a switch-based counting and serial communication system using the AT89C51ED2 microcontroller. The program read the status of a switch and performed 8-bit counting on the output pins based on the switch value. Serial communication was achieved using UART at a baud rate of 2400. This project demonstrated the utilization of digital I/O, timers, and UART modules in an embedded system. The system has potential applications in automation and control systems. By understanding the configuration and initialization of UART and the microcontroller's features, we gained practical insights into switch-based operations and serial data transmission in an embedded environment.

9.References:

1. Atmel. "AT89C51ED2 Datasheet." [Online]. Available: http://ww1.microchip.com/downloads/en/devicedoc/doc0619.pdf.

2. Mazidi, Muhammad Ali, and Janice Gillispie Mazidi. "The 8051 Microcontroller and Embedded Systems: Using Assembly and C." Pearson Education, 2018.

3. Ayala, Kenneth J. "The 8051 Microcontroller Architecture, Programming, and Applications." Cengage Learning, 2006.

4. UART Communication Basics: [Online]. Available: https://www.electronicwings.com/8051/uart-communication-basics

5. 8051 Microcontroller Serial Communication Modes: [Online]. Available: https://www.elprocus.com/8051-microcontroller-serial-communication-modes/