VIETNAM NATIONAL UNIVERSITY, HANOI

INTERNATIONAL SCHOOL

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INS3135 – SIMULATION OF DIGITAL CIRCUITS

PROJECT REPORT

Wireless Electronic Notice Board using GSM

Information

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BỘ GIÁO DỤC VÀ ĐÀO TẠO

TRƯỜNG QUỐC TẾ - ĐHQGHN

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FINAL REPORT

TOPIC:
Wireless Electronic Notice Board using GSM

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I. Introduction

1.1. About project

Communication plays a pivotal role in connecting individuals and disseminating information, especially in the current era marked by rapid technological advancements. Traditional methods of conveying notifications and announcements have undergone a revolutionary transformation, primarily driven by advancements in wireless communication technologies. A noteworthy innovation in this realm is the "Wireless Electronic Notification Board using GSM" – an avant-garde system poised to revolutionize information dissemination across various settings.

This project harnesses the capabilities of the Global System for Mobile Communications (GSM) technology to create a dynamic and adaptable electronic notification board. Unlike conventional boards that rely on manual updates and physical presence, the wireless electronic notification board facilitates seamless information communication from a remote location to the display unit. By integrating GSM functionalities, this system opens up new possibilities for real-time updates, making it an ideal solution for diverse environments such as educational institutions, corporate offices, public spaces, and event venues.

The Wireless Electronic Notification Board using GSM leverages the ubiquity of mobile networks to offer a flexible and efficient means of information distribution. Beyond expediting information delivery and enhancing accuracy, this project eliminates the necessity for a constant physical presence at the notice board's location. To delve deeper into the intricacies of this innovative system, we will explore its components, operational mechanisms, and the myriad advantages it presents for contemporary communication systems. Join us on a journey into the realm of wireless connectivity, where the convergence of GSM technology and electronic notification boards promises to redefine how we share and receive information in today's fast-paced world.

1.2. Motivation

The genesis of the Wireless Electronic Notice Board using GSM can be traced back to a recognition of a prevalent issue, particularly within the domain of public transportation. At present, a considerable number of bus stations lack the convenience of electronic bulletin boards, leaving passengers uninformed about the impending arrival of buses at their designated stops. This information void not only introduces challenges to the overall passenger experience but also creates impediments in the effective management of public transport systems. Drawing from our own experiences as frequent bus users, we intimately understand the frustration of not knowing when the next bus will arrive, identifying this as a significant pain point in daily commuting that demands urgent attention.

In response to this immediate concern, our short-term objective revolves around developing a product tailored to the specific needs of bus commuters. The Wireless Electronic Notice Board using GSM is designed to furnish real-time information about bus schedules, empowering passengers to plan their journeys more efficiently and mitigating the uncertainties associated with public transportation. By alleviating this pain point, our project aims to significantly enhance the overall experience for bus users, contributing to a more seamless and user-friendly public transport system.

While our immediate focus is on the application of this technology in bus stations, our long-term vision extends beyond, envisioning its adaptation for diverse environments such as education, transportation, healthcare, and more. The inherent versatility of the electronic notice board, combined with the robust capabilities of GSM technology, positions it as a solution with broad applicability. By successfully addressing the specific challenges faced by bus commuters, our project lays the foundation for a scalable and adaptable system that has the potential to positively impact various sectors. This includes making information dissemination more efficient and accessible.

1.3. Main objective of the project

The project aims to improve the passenger experience by providing accurate and detailed information on bus arrival times, allowing passengers to plan their trips more efficiently and avoid waiting blindly at the bus station.

Additionally, it enhances traffic management and public transportation by offering real-time traffic schedules and status, enabling managers to effectively coordinate resources and minimize traffic congestion, thus improving the overall system flexibility.

Another significant benefit is the time-saving and stress reduction for passengers, as they no longer have to wait blindly and can manage their time more effectively, alleviating the stress associated with waiting for transportation.

Moreover, the project enhances flexibility and responsiveness by promptly updating information and easily adapting to changes in schedules or emergency traffic situations.

Lastly, the project promotes public transportation and environmental protection by encouraging the use of public transportation over private vehicles, resulting in reduced traffic congestion and supporting a sustainable living environment. It also provides an opportunity to enhance the public transport system and better cater to the growing needs of the community.

1.4. Potential Customers

Examining the current state of the public transport system reveals significant challenges, particularly at bus stations, where state and management organizations grapple with operational difficulties. The absence of accurate and reliable information concerning waiting times and bus schedules poses substantial hurdles for passengers, exacerbating the strain on the entire transport system.

Recognizing the pivotal role of precise and timely information in enhancing the overall transportation experience, governmental bodies and public transport management organizations are increasingly acknowledging the imperative of investing in electronic bulletin board projects. The incorporation of GSM technology in these initiatives is a strategic move, with the dual objectives of elevating passenger satisfaction and optimizing traffic management to enhance overall system performance.

The strategic adoption of this project represents a conscientious effort by the state to create a modern, flexible, and responsive public transportation environment that aligns with the burgeoning needs of the community. The advantages derived from this initiative, including heightened service quality, reduced traffic congestion, and increased utilization of public transport, collectively contribute to sustainable development and elevate the comfort quotient in people's daily lives.

Cognizant of the deficiencies and challenges faced by bus stations lacking electronic notice boards, the government and public transport management organizations are increasingly attuned to the significance of deploying wireless electronic bulletin board projects using GSM technology. The procurement and implementation of such projects promise multifaceted benefits, offering opportunities to significantly enhance the quality of public transport services. This forward-looking approach not only addresses the immediate issues faced by passengers but also positions the public transport system as a catalyst for positive change, contributing to the overall well-being and convenience of the populace.

1.5. Sub Objectives

- Aim 1: Design and Assemble Hardware Components for the Wireless Electronic Notice Board
- Aim 2 application design Wireless Electronic Notice Board using GSM in real life
- Aim 3: Product Sales and Marketing Strategy
- Aim 4: Addition function after release

II. Hardware and software

2.1. Proteus

Proteus software is a widely used application that enables engineers and electronic designers to design and simulate electronic systems. By providing a virtual environment, Proteus allows users to design, test, and simulate electronic circuits before they are constructed. This software is commonly utilized in the development and testing of various electronic components such as circuits, microcontrollers, microprocessors, and embedded systems. With Proteus, engineers can preview and assess the performance of their circuits without the necessity of creating physical prototypes.

Figure 1 Proteus

2.2. Keil uVision5

Keil uVision5 is an integrated development environment (IDE) widely used for the development of embedded systems. It provides a comprehensive platform for writing, testing, and debugging software code targeted for microcontrollers, microprocessors, and other embedded devices. Keil uVision5 supports various programming languages, including C and Assembly, and offers a range of features such as code editing, project management, and real-time simulation.

Figure 2 Keil uVision5

One of the notable features of Keil uVision5 is its compatibility with a variety of microcontroller architectures, making it a versatile tool for embedded systems development. Additionally, it includes a debugger that allows developers to analyze and troubleshoot their code efficiently, ensuring the reliability and functionality of the embedded systems they are working on. Overall, Keil uVision5 plays a crucial role in the development lifecycle of embedded systems, providing a user-friendly and efficient environment for programmers and engineers.

2.3. AT89C51

AT89C51 is a popular microcontroller model utilized in Proteus, an electronic simulation software. The AT89C51 is a member of the 8051 microcontroller family manufactured by Atmel. It features a 4K Bytes Flash programmable and erasable

Figure 3 AT89C51

read-only memory (PEROM), 128 Bytes of RAM, 32 I/O lines, two 16-bit timer/counters, a full-duplex UART, a six-source, and two-level interrupt priority controller. This microcontroller is widely used in embedded systems and various electronic applications due to its versatile features and ease of programming. In Proteus, the AT89C51 model allows designers and developers to simulate and test their microcontroller-based projects before implementing them in hardware, facilitating efficient development and troubleshooting processes.

2.4. LCD

2.4.1. LCD hardware

An LCD (Liquid Crystal Display) is an electronic component used for displaying information in a visual format. It is a flat-panel display technology that uses liquid crystals to control the passage of light, allowing it to produce text, images, or other graphical content. LCDs are commonly used in various electronic devices, such as computer monitors, television screens, digital clocks, and, in the context of embedded systems, for displaying information in microcontroller-based projects.

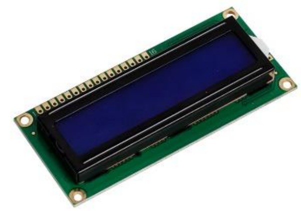


Figure 4 LCD

2.4.2. LCD in proteus

In the context of Proteus, LCD typically refers to the simulation model of an LCD that can be used in conjunction with microcontroller simulations. Proteus provides a virtual environment where you can design and simulate electronic circuits and systems, including microcontroller-based projects. The LCD component in Proteus allows you to simulate how information would be displayed on an LCD screen connected to a microcontroller, facilitating testing and debugging before the actual hardware implementation.

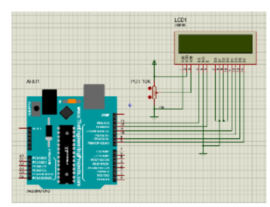


Figure 5 LCD in proteus

III. Overview of GSM Technology

3.1. History and Development

Figure 6 GSM

GSM, also known as Global System for Mobile Communications, has played a crucial role in the advancement of mobile communication technologies. It was developed in the early 1980s and became an international standard for digital cellular communication, replacing the analog systems that were prevalent at that time. The collaborative efforts of multiple European nations led to its creation, and the first GSM call was successfully made in 1991. Throughout the years, GSM has undergone various upgrades, progressing from 2G to more advanced generations such as 3G and 4G, with ongoing developments towards 5G technology. The standardized nature of GSM has been instrumental in facilitating seamless global communication.

3.2. Advantages and Disadvantages

3.2.1. Advantages

- Global Standardization: One of GSM's key strengths is its global standardization, facilitating interoperability and seamless communication across different networks and regions.
- Security: GSM incorporates robust security measures, including encryption techniques, making it more resistant to unauthorized access and eavesdropping.
- Efficiency in Bandwidth Usage: GSM optimizes bandwidth usage efficiently, allowing for a greater number of users to share the available spectrum.

3.2.2. Disadvantages

- Limited Data Transfer Speeds: As an early-generation technology, GSM was primarily designed for voice communication, resulting in limited data transfer speeds compared to more recent technologies like 4G and 5G.
- Spectral Efficiency: While efficient, GSM's spectral efficiency may fall short compared to more modern systems, leading to potential congestion in high-density usage scenarios.
- Technological Obsolescence: With the advent of newer technologies, GSM is gradually becoming obsolete, posing challenges for legacy systems and devices.

3.3. Operation and Applications

GSM operates on a combination of time division multiple access (TDMA) and frequency division multiple access (FDMA) principles. Time slots are allocated to multiple users within a frequency band, enabling concurrent communication without interference. GSM technology finds widespread applications, extending beyond mobile communication:

- Mobile Telephony: The primary application of GSM is in mobile phones, providing voice and short message services (SMS).
- Data Communication: Though relatively slower, GSM supports data services, enabling internet connectivity and basic data transfer.
- Internet of Things (IoT): GSM's reach and reliability make it suitable for connecting various IoT devices, enhancing the capabilities of smart cities and industrial applications.
- Security Systems: GSM is utilized in security systems such as alarms and surveillance, leveraging its reliability and global reach for remote monitoring.

3.4. Applications of GSM Combined with Proteus and AT89C51 for Traffic Notification and Public Transportation

3.4.1. System Architecture

Combining GSM technology with Proteus simulation and the AT89C51 microcontroller presents a powerful solution for real-time traffic notification and public transportation services. The AT89C51 acts as the central processing unit, interfacing with various sensors and the GSM module to facilitate seamless communication and control.

3.4.2. Real-Time Traffic Notification

By integrating GSM technology with Proteus and AT89C51, the system can monitor traffic conditions in real time. Sensors placed strategically along roadways can detect traffic density and congestion, sending this information to the microcontroller. The AT89C51 processes the data and triggers GSM notifications to relevant authorities, allowing for timely responses to alleviate traffic issues and improve overall road management.

3.4.3. Public Transportation Notification

The system excels in enhancing public transportation services, particularly for bus commuters. Utilizing GSM capabilities, the AT89C51 microcontroller receives and processes data regarding bus schedules and real-time location updates.

Passengers waiting at bus stops receive automated notifications through GSM, informing them of the approaching bus and its estimated time of arrival. This proactive communication minimizes uncertainties, enhances passenger experience, and contributes to the overall efficiency of the public transportation system.

3.4.4. Intelligent Traffic Management

The integration of Proteus and AT89C51 enables the creation of an intelligent traffic management system. The microcontroller processes data from various sources, including traffic sensors and public transportation schedules, to dynamically adjust traffic signals based on real-time conditions. This adaptive system contributes to reduced congestion, improved traffic flow, and a more responsive urban infrastructure.

3.4.5. Benefits and Impact

Enhanced Public Transportation Experience: Passengers receive timely notifications, reducing wait times and improving the overall experience of using public transportation.

Efficient Traffic Management: The system contributes to more efficient traffic flow, minimizing congestion, and optimizing the use of road infrastructure.

Proactive Decision-Making: Authorities can make informed decisions based on real-time data, leading to more effective responses to traffic issues and public transportation challenges.

Smart City Integration: The integrated solution aligns with the broader concept of smart cities, leveraging technology to create more sustainable and livable urban environments.

IV. Comparison with Other Technologies

4.1. Criteria for Comparison

When evaluating GSM technology in the context of real-time traffic notification and public transportation systems, various criteria come into play. These include:

- Data Transfer Speed: The speed at which information is transmitted.
- Communication Range: The distance over which devices can communicate effectively.
- Security Features: Measures in place to ensure the confidentiality and integrity of transmitted data.
- Cost: The financial implications associated with implementing and maintaining the technology.
- Scalability: The ease with which the technology can be expanded or adapted to handle increased demand.
- Reliability: The consistency and dependability of the technology in real-world applications.

4.2. Evaluation of Each Technology

4.2.1. GSM Technology

- Data Transfer Speed: Moderate, suitable for voice and basic data services.
- Communication Range: Global reach, making it ideal for widespread applications.
- Security Features: Robust encryption protocols ensure secure communication.
- Cost: Generally cost-effective, especially considering its widespread adoption.
- Scalability: Easily scalable for various applications, especially with advancements like 4G and 5G.
- Reliability: Proven reliability for voice communication; may face limitations in high-density data usage scenarios.

4.2.2. Other Wireless Technologies

- Data Transfer Speed: Varied, with technologies like 4G and 5G offering higher speeds.
- Communication Range: Varies; some technologies may have limited range compared to GSM.
- Security Features: Depending on the technology, security features may differ, with some offering advanced encryption.

- Cost: Costs can vary, with newer technologies potentially requiring higher initial investments.
- Scalability: Newer technologies like 5G are designed with scalability in mind.
- Reliability: Depends on the specific technology; newer generations often offer improved reliability.

4.3. Reasons for Choosing GSM Technology over Other Alternatives

4.3.1. Global Reach and Standardization

GSM Advantage: GSM technology's global standardization allows for seamless communication across different networks and regions, making it a preferred choice for applications with a broad geographical scope.

Comparison: While newer technologies may offer higher data transfer speeds, the global reach of GSM remains unparalleled, ensuring consistent performance across diverse locations, which is crucial for real-time traffic and public transportation systems that operate in urban and suburban areas.

4.3.2. Cost-Effectiveness

GSM Advantage: GSM technology is generally more cost-effective, especially when considering its widespread adoption and compatibility with existing infrastructure.

Comparison: Newer technologies may come with higher initial investments and maintenance costs. The cost-effectiveness of GSM makes it an attractive option for applications that prioritize economic considerations without compromising essential functionalities.

4.3.3. Security Measures

GSM Advantage: GSM incorporates robust security measures, including encryption techniques, providing a secure platform for transmitting sensitive information.

Comparison: While other technologies may offer advanced security features, GSM's established encryption protocols make it a reliable choice for applications where data security is paramount, such as real-time traffic notification and public transportation systems.

4.3.4. Proven Reliability in Voice Communication

GSM Advantage: GSM has a long history of proven reliability in voice communication, showcasing its stability and dependability.

Comparison: Newer technologies may excel in data transfer speeds but may not have the same track record of reliability in voice communication. For applications like public transportation, where voice communication is crucial, GSM's proven reliability is a deciding factor.

4.3.5. Scalability and Compatibility

GSM Advantage: GSM technology is easily scalable and compatible with various applications, making it adaptable to the evolving needs of real-time traffic and public transportation systems.

Comparison: While newer technologies may be designed for scalability, GSM's compatibility with a wide range of devices and systems enhances its versatility and makes it a pragmatic choice for applications that require flexible and scalable solutions.

4.3.6. Consideration of Legacy Systems

GSM Advantage: In scenarios where legacy systems are prevalent, GSM's compatibility with older infrastructure can be a crucial factor in decision-making.

Comparison: Transitioning to newer technologies may require significant overhauls in existing systems, while GSM allows for a more gradual and cost-effective upgrade path, making it a pragmatic choice in environments where legacy systems are a consideration.

4.4. Conclusion

In conclusion, the selection of GSM technology over alternative solutions is rooted in its global reach, cost-effectiveness, security measures, proven reliability, scalability, and compatibility with legacy systems. These factors collectively make GSM a pragmatic and reliable choice for real-time traffic notification and public transportation applications, addressing specific requirements while offering a balance of essential features and economic considerations.

V. Practical Implementation

5.1. Setting up Proteus for GSM Technology

5.1.1. Download and Install Proteus

- Visit the official Labcenter Electronics website https://www.labcenter.com/ to download the latest version of Proteus.
- Follow the installation instructions provided during the setup process.

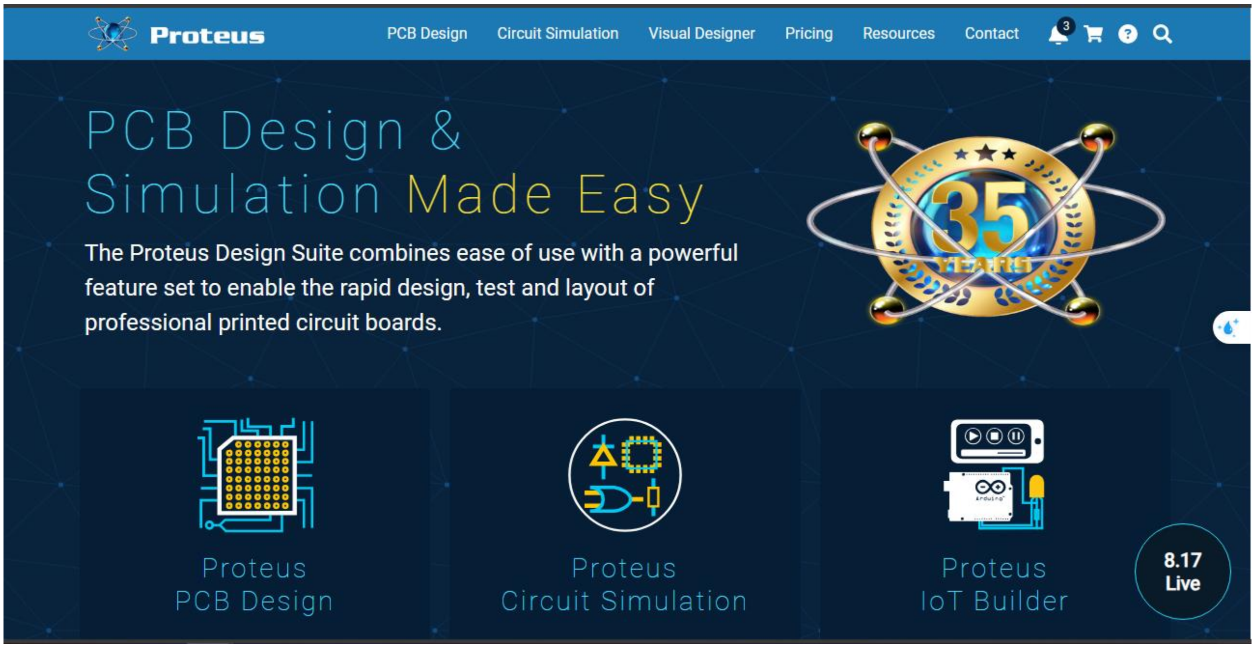


Figure 7 Install Proteus

5.1.2. Adding GSM Module to the Project

- Open Proteus and create a new project.
- Select the "ISIS" workspace for schematic design.
- From the components library, locate and add the GSM module to the schematic.

5.1.3. Configuring GSM Module

- Double-click on the GSM module to open its properties.
- Set the necessary parameters such as baud rate, communication settings, and power supply specifications.

5.1.4. Interfacing with Microcontroller

- Add the AT89C51 microcontroller to the schematic.
- Connect the necessary pins of the GSM module to the microcontroller, ensuring proper interfacing.

5.1.5. Writing Program Code

- Open the Proteus IDE and write the code for the AT89C51 microcontroller using an appropriate programming language such as C.
- Ensure the code includes functions to communicate with the GSM module, process data, and trigger responses.

5.1.6. Simulating the Project

- Run the simulation to observe the interaction between the microcontroller and the GSM module.
- Verify that the communication, data processing, and responses align with the intended functionalities.

5.2. Configuring Keil uVision5 for AT89C51

5.2.1. Download and Install Keil uVision5

- Go to the ARM official website to download the latest version of Keil uVision5.
- Follow the installation instructions provided during the setup process.

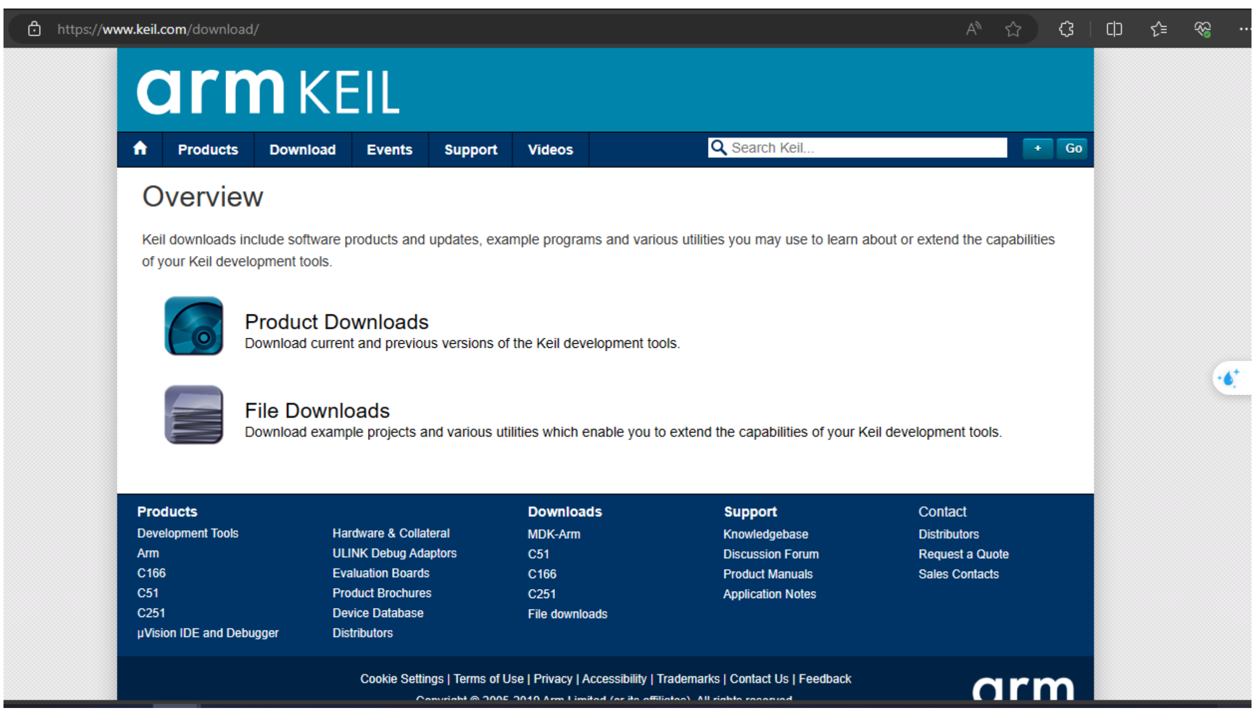


Figure 8 Install Keil uVision5

5.2.2. Creating a New Project

- Open Keil uVision5 and create a new project for the AT89C51 microcontroller.
- Specify the project location and select the AT89C51 as the target device.

5.2.3. Writing Code

- Write the program code using the integrated Keil C compiler.
- Ensure the code includes the necessary functions for interfacing with the GSM module, processing data, and controlling the system.

5.2.4. Configuring Compiler and Debugger

- Set the compiler options and configurations to match the specifications of the AT89C51 microcontroller.
- Configure the debugger settings for simulation or target hardware, depending on the development environment.

5.2.5. Building and Debugging

- Build the project to generate the hex file.
- Use the debugger to analyze the code, set breakpoints, and debug any issues in the program.

5.2.6. Flashing the Microcontroller

If using external hardware, flash the hex file onto the AT89C51 microcontroller using an appropriate programmer.

5.2.7. Testing on Hardware/Proteus

Test the code on the actual hardware or simulate it in Proteus to ensure proper functionality and adherence to the project requirements.

VI. Methodology and Milestones

6.1. Methodology

The development of a Wireless Electronic Notice Board utilizing GSM technology for public transportation, with a primary focus on broadcasting bus schedules, involves a systematic approach covering hardware design, software development, and testing phases [1]

6.1.1. Aim 1: Design and Assemble Hardware Components (Utilizing Proteus)

6.1.1.1. Comprehensive Hardware Design using Proteus

- **Objective:**

Develop a comprehensive hardware design for the Wireless Electronic Notice Board utilizing Proteus. Emphasize considerations for power efficiency, scalability, and ease of assembly.

- **Implementation Steps:**

Utilize Proteus for schematic design, ensuring meticulous planning for optimal power utilization.

Prioritize scalability by selecting components that allow for future expansions or enhancements.

Emphasize ease of assembly, considering factors such as component placement and connection simplicity.

6.1.1.2. Procurement of High-Quality Hardware Components

- **Objective**

Identify and acquire top-notch hardware components that align with the design specifications, ensuring compatibility and reliability for seamless integration.

- **Implementation Steps**

Thoroughly research and select hardware components based on compatibility with the Proteus-designed schematic.

Prioritize reliability and compatibility to guarantee the successful integration of components into the Wireless Electronic Notice Board system.

Consider industry standards and reviews to validate the quality and reliability of selected hardware components.

6.1.1.3. Assembly of Hardware Components using Proteus

- **Objective:**

Assemble the selected hardware components using Proteus for firmware programming, adhering to industry best practices and safety standards to ensure overall system robustness.

- **Implementation Steps:**

Utilize Proteus to simulate the assembly of hardware components, verifying their compatibility and functionality.

Employ industry best practices in firmware programming within Proteus to enhance system reliability.

Ensure compliance with safety standards throughout the assembly process, addressing potential risks and vulnerabilities.

6.1.2. Aim 2: Application Design Using GSM (Integrating Proteus)

6.1.2.1. Creation of User-Friendly Application Interface

- **Objective:**

Develop a user-friendly and intuitive application interface for the Wireless Electronic Notice Board using Proteus. Prioritize accessibility and ease of use for users from diverse demographics.

- **Implementation Steps:**

Leverage Proteus for application interface design, ensuring a seamless and visually appealing user experience.

Incorporate accessibility features to cater to users with varying needs and preferences.

Conduct usability testing to refine the interface based on user feedback, optimizing its overall design and functionality.

6.1.2.2. Integration of GSM Technology using Proteus

- **Objective:**

Incorporate GSM technology into the application using Proteus, enabling real-time communication and updates to the Electronic Notice Board for a reliable and secure connection.

- **Implementation Steps:**

Utilize Proteus for simulating the integration of GSM technology with the application.

Ensure seamless communication between the application and the Electronic Notice Board through the simulated GSM module.

Address security considerations to establish a robust and secure connection for real-time information sharing.

6.1.2.3. Implementation of Advanced Features using Proteus

- **Objective:**

Enhance the practicality and functionality of the Wireless Electronic Notice Board by implementing features such as message scheduling, remote management, and notification alerts, utilizing Proteus.

- **Implementation Steps:**

Leverage Proteus to develop and integrate advanced features into the application, enabling message scheduling for timely updates.

Implement remote management functionalities, allowing administrators to efficiently control and monitor the Notice Board.

Incorporate notification alerts to provide users with real-time information, enhancing the overall user experience.

6.1.3. Aim 3: Product Sales and Marketing Strategy

6.1.3.1. Market Research for Target Audience and Competitors

- **Objective:**

Conduct comprehensive market research to identify target audiences, competitors, and potential sales channels for the Wireless Electronic Notice Board.

- **Implementation Steps:**

Analyze market trends, customer demographics, and competitor offerings to identify niche opportunities.

Identify potential sales channels, including online platforms, retailers, and distributors, through thorough market analysis.

6.1.3.2. Development of Comprehensive Marketing Strategy

- **Objective:**

Develop a comprehensive marketing strategy that encompasses both online and offline channels to raise awareness and generate interest in the Wireless Electronic Notice Board.

- **Implementation Steps:**

Utilize a mix of online marketing tools, such as social media, SEO, and content marketing, alongside traditional offline channels like print media and events.

Tailor marketing strategies to resonate with the identified target audiences, emphasizing the unique features and benefits of the product.

6.1.3.3. Establishment of Partnerships and Collaborations

- **Objective:**

Establish partnerships and collaborations with distributors, retailers, and other stakeholders to facilitate the sales and distribution of the Wireless Electronic Notice Board.

- **Implementation Steps:**

Identify potential partners through targeted outreach and collaboration proposals.

Develop mutually beneficial partnerships that streamline the distribution process and enhance the product's reach in the market.

6.1.3.4. Implementation of Effective Sales Plan

- **Objective:**

Implement an effective sales plan that incorporates customer feedback and continuous improvement to optimize the product's market presence and achieve sales targets.

- **Implementation Steps:**

Collect and analyze customer feedback to identify areas for improvement and address any issues promptly.

Continuously refine the sales strategy based on market dynamics, customer preferences, and the evolving competitive landscape.

6.1.4. Aim 4: Post-Release Feature Enhancement and Expansion

6.1.4.1. Continuous Feedback Collection

- **Objective:**

Establish a mechanism for collecting continuous feedback from users and stakeholders post product release to identify areas for improvement and potential feature additions.

- **Implementation Steps:**

Set up feedback channels, including online surveys, customer support interactions, and user forums.

Regularly analyze collected feedback to understand user experiences, preferences, and emerging needs.

6.1.4.2. Iterative Software Updates using Proteus

- **Objective:**

Utilize Proteus to iteratively develop and release software updates, incorporating user feedback and introducing new features to enhance the functionality of the Wireless Electronic Notice Board.

- **Implementation Steps:**

Leverage Proteus for simulating software updates, ensuring compatibility and stability before deployment.

Prioritize user-requested features and improvements identified through feedback for each software update.

Implement a structured release schedule for iterative updates, communicating changes to users effectively.

6.1.4.3. Integration of Emerging Technologies

- **Objective:**

Explore and integrate emerging technologies that align with the evolving needs of users and the technological landscape.

- **Implementation Steps:**

Stay abreast of technological advancements and trends relevant to communication systems and public displays.

Assess the feasibility and potential impact of integrating new technologies, such as AI-driven features or enhanced connectivity options.

Gradually introduce and test these technologies through Proteus simulations before implementing them in the live environment.

6.1.4.4. Community Engagement and Co-Creation

- **Objective:**

Foster a sense of community engagement by involving users in the co-creation process, allowing them to contribute ideas and suggestions for new functionalities.

- **Implementation Steps:**

Establish online platforms or forums where users can share their ideas and vote on proposed features.

Encourage a collaborative environment where users feel a sense of ownership and involvement in the evolution of the Wireless Electronic Notice Board.

6.1.4.5. Scalability Planning and Infrastructure Enhancement

- **Objective:**

Plan for the scalability of the system by continuously assessing the growing user base and expanding infrastructure to accommodate increased demands.

- **Implementation Steps:**

Regularly evaluate system performance metrics and user adoption rates to anticipate scalability requirements.

Enhance server capacities, data storage, and communication protocols using Proteus simulations to ensure a smooth transition and implementation in the live environment.

6.1.4.6. Documentation and Training Updates

- **Objective:**

Keep product documentation and user training materials up-to-date to reflect new features and functionalities introduced after the initial release.

- **Implementation Steps:**

Update user manuals, guides, and online documentation to include information about the latest features and improvements.

Conduct periodic training sessions for users to familiarize them with the added functionalities, using Proteus simulations to demonstrate new features.

6.2. Project Implementation and Evaluation

6.2.1. Integration and System Testing

- **Leveraging Proteus and Keil uVision5 for System Testing:**

Seamlessly integrate the hardware and software components within Proteus and Keil uVision5 to form a comprehensive Wireless Electronic Notice Board system.

Execute thorough system testing using Proteus to identify and rectify potential integration issues, ensuring the robust functionality of the entire system.

6.2.2. User Acceptance Testing (UAT)

- **Incorporating End-User Engagement:**

Actively involve end-users in the testing phase to collect valuable feedback, ensuring alignment with their needs and expectations.

Employ Proteus for simulation and Keil uVision5 for necessary adjustments based on user feedback, enhancing the overall user experience and system performance.

6.2.3. Deployment Planning and Execution

- **Strategic Implementation in Practical Environments:**

Strategically plan and meticulously execute the deployment of the Wireless Electronic Notice Board in real-world scenarios, employing both Proteus and Keil uVision5 in the process.

Conduct comprehensive training sessions for end-users and support staff, utilizing Keil uVision5 to ensure seamless operation and effective utilization of the system in practical settings.

6.2.4. Marketing Campaign Launch

- **Implementation of a Multi-Channel Marketing Strategy:**

Execute a dynamic marketing campaign to maximize product visibility, utilizing a diverse array of channels, including social media, conferences, and collaborative efforts with industry partners.

Employ Proteus simulations to create engaging marketing materials and leverage Keil uVision5 for content optimization, ensuring a cohesive and impactful campaign launch.

6.2.5. Sales Monitoring and Optimization:

- **Development of a Real-Time Sales Monitoring System:**

Develop and implement a sophisticated system for real-time monitoring of sales performance and customer feedback, incorporating both Proteus and Keil uVision5.

Utilize market response and user feedback to continually refine and optimize the sales strategy, fostering improved sales performance and heightened customer satisfaction.

6.2.6. Project Evaluation:

- **Comprehensive Assessment Across Multiple Dimensions:**

Conduct a holistic evaluation of the entire project, analyzing the extent to which objectives have been met and the project's adherence to established timelines.

Leverage insights gained from both Proteus simulations and Keil uVision5 analyses to assess the overall success of the project, taking into account various performance metrics and user satisfaction levels.

6.3. Milestones and Timeline

6.3.1. Milestones

STT	Title	Estimate time
1	Research information	2.5 weeks
2	Simulation	1 week
3	Report	2 weeks
4	Slide and presentation	1 week

Table 1 Milestones

6.3.2. Timeline

Based on our project timeline diagram, it seems that the most challenging aspect of the project is circuit design and simulation. I have dedicated over 2 weeks to this task, and below are some key achievements and challenges we are currently facing:

Progress achieved: Designed and implemented a significant part of the main circuit.

Completed some preliminary simulations to assess the accuracy and performance of the circuit.

Challenges being faced: Encountering difficulties in integrating circuit components and ensuring proper interaction between them.

Needing additional time to perform detailed simulations and comprehensive testing before moving on to the production phase.

Next steps: Focus on resolving specific issues encountered during the simulation process.

Plan for real-world testing and adjust the circuit if necessary.

Continue monitoring and addressing any new challenges that may arise in the subsequent development stages.

Particular attention and emphasis on the circuit and simulation phase are crucial to ensuring a solid infrastructure before moving forward with the next steps of the project.

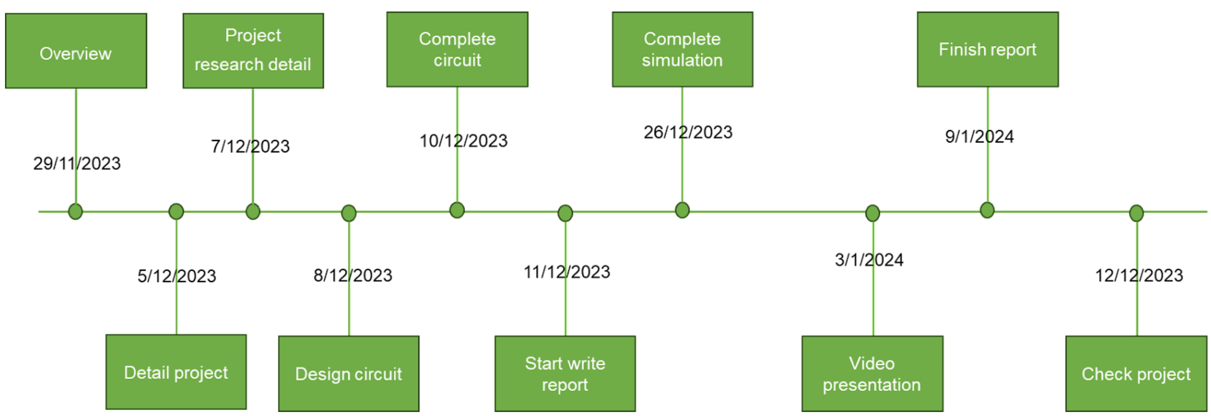


Table 2 Timeline

VII. Project Outcomes & Specific Project Deployment

7.1. Project Circuit Simulation

Software: proteus and keil uVission5

7.1.1. Devices

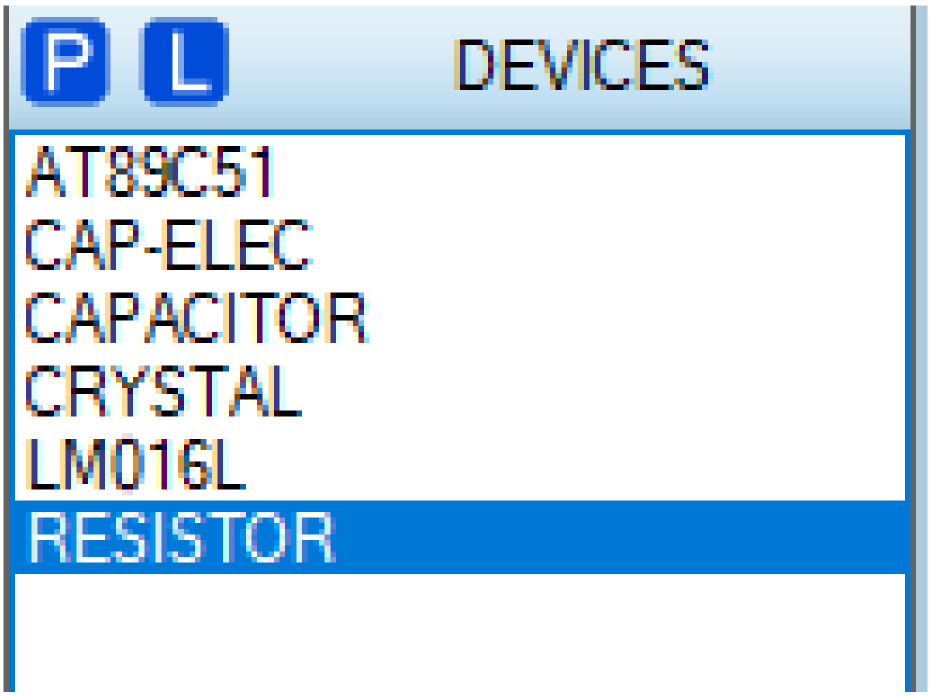


Figure 9 Devices

- AT89C51: is a popular 8-bit microcontroller that belongs to the 8051 family of microcontrollers. It is widely used in embedded systems and electronic applications due to its versatility, reliability, and ease of use. The AT89C51 is manufactured by Atmel, which is now a part of Microchip Technology

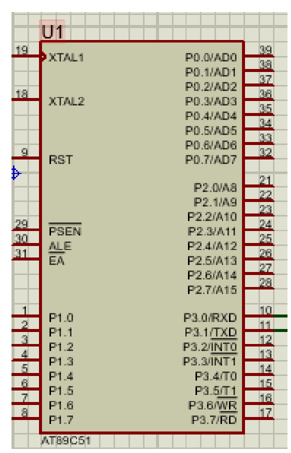


Figure 10 AT89C51 Chip

- Capacitor/cap-elec: A capacitor is a fundamental electronic component that stores electrical energy in an electric field. It consists of two conductive plates separated by an insulating material known as a dielectric. The capacitance value, measured in farads (F), represents the ability of a capacitor to store charge per unit voltage.

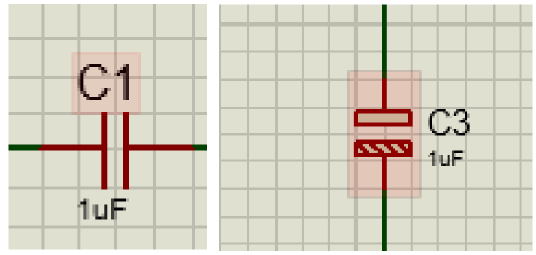


Figure 11 Capacitor/cap-elec

- Crystal: typically refers to a crystal oscillator or simply a crystal. A crystal oscillator is an electronic circuit that uses the mechanical resonance of a vibrating crystal of piezoelectric material to generate an electrical signal with precise frequency. Crystals are widely used in electronic devices for providing accurate timing references.

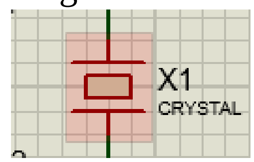


Figure 12 Crystal

- LM016L: is a liquid crystal display (LCD) module that is commonly used in various electronic applications for displaying alphanumeric characters. It provides a simple and efficient way to incorporate text output into microcontroller-based projects. The LM016L typically operates with a parallel interface and is compatible with various microcontrollers.

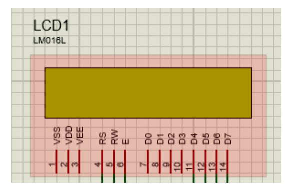


Figure 13 LM016L

- Register: In digital systems and microprocessor/microcontroller architecture, a register is a small, fast storage unit typically found within the CPU. Registers store binary data temporarily for processing.

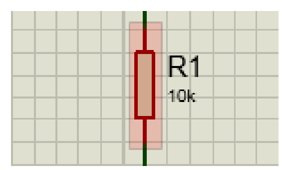


Figure 14 Register

7.2. Project circuit simulation

- Draw the circuit in proteus

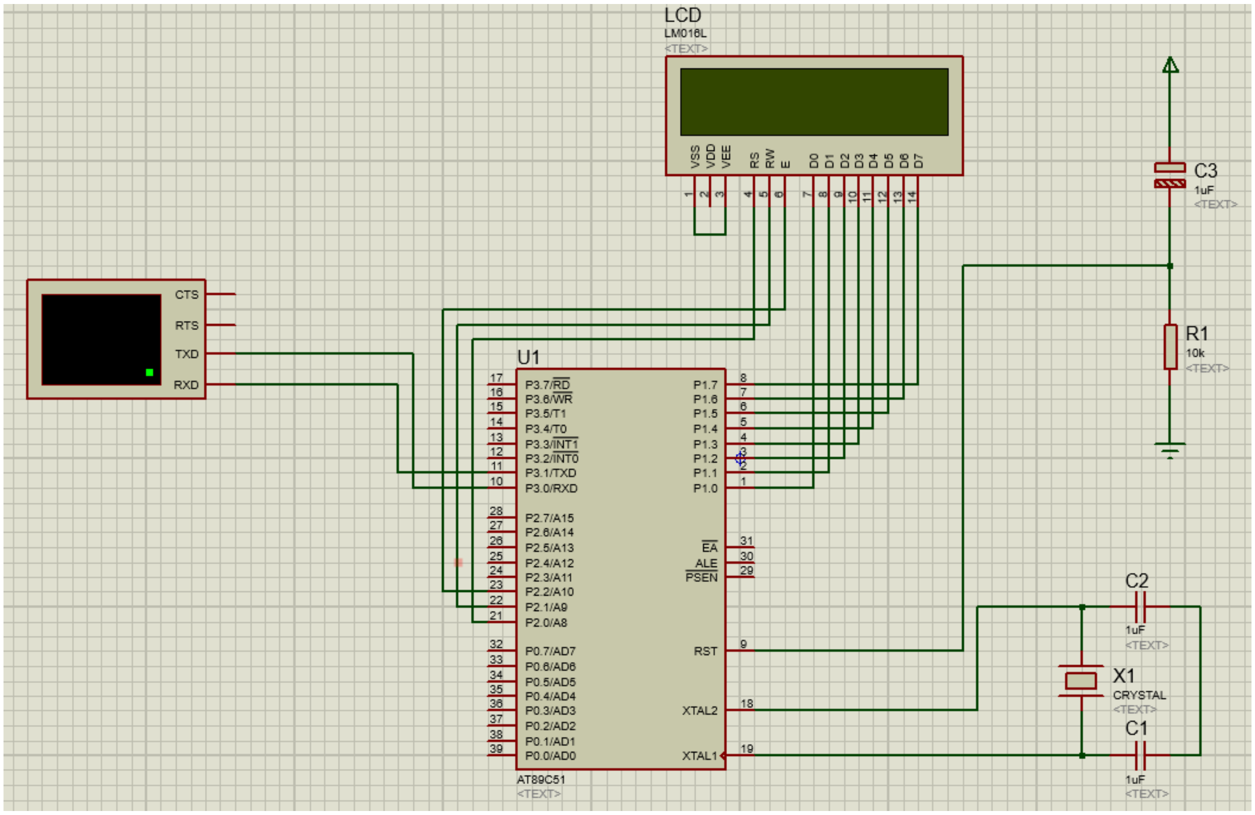


Figure 15 Draw the circuit in proteus

7.2.1. Visual Introduction

This schematic is a microcontroller-based system, probably an embedded application. The main component, labeled U1, is the microcontroller (MCU), which seems to be from the ATMEL family, given the naming convention (ATmega or ATtiny series). The MCU is connected to various passive components and connectors that serve different functions:

- C1, C2: These are capacitors, likely used for power supply filtering or for decoupling. Decoupling capacitors are used to prevent high-frequency noise from the power supply from affecting the MCU.
- X1: This appears to be a crystal oscillator, which provides a precise clock signal for the MCU. The crystal frequency is typically specified in MHz.
- R1, R4, R5: These are resistors. R1 might be a pull-up or pull-down resistor for the reset line. R4 and R5 are likely termination resistors for the communication lines or for other signal conditioning purposes.
- LED1: This is a light-emitting diode, which is usually used as an indicator light. The series of pins beneath LED1 are likely to be the individual segments of a seven-segment display to show numbers or characters.

- C3: Another capacitor, which might be used in conjunction with the crystal oscillator (X1) for timing stability.
- J1: This is a connector, probably for programming the microcontroller or for connecting it to other devices.
- RST, INT0, etc.: These are pins on the microcontroller. RST is the reset pin, while others like INT0 might be used for external interrupts.
- The lines between the components represent electrical connections. When assembled on a printed circuit board (PCB), these lines would be actual wires or traces that electrically connect the components together.
- Power Supply Connections: Components like capacitors C1 and C2, and the resistor R1 are connected to what seems to be the power supply lines (often indicated by the labels VCC for positive voltage and GND for ground). These connections provide power to the microcontroller and other components.

7.2.2. Hardware Connections for PIC AT89C51 Microcontroller and LCD Modules

In this section, the intricate details of connecting various electronic components, including capacitors, resistors, and LCD modules, to the PIC AT89C51 microcontroller are discussed. This comprehensive guide provides step-by-step instructions for creating the physical connections necessary for the proper functioning of the hardware components.

- Connect Capacitor C1: Connect one end of capacitor C1 to the OSC1/CLKI pin of the integrated circuit U1 (PIC AT89C51).
- Connect Capacitor C2: Connect one end of capacitor C2 to the OSC2/CLKO pin of U1.
- Connect Resistor R3: Connect one end of resistor R3 to the MCLR pin of U1 and the other end to a 5V source.
- Connect LCD1 to U1: Connect the RA0-RA4 pins of U1 respectively to the D4-D7 pins of the LCD display module LCD1.
- Connect LCD2 to U1: Connect the RB0-RB7 pins of U1 respectively to the D0-D7 pins of the LCD display module LCD2.
- Ground R/W pin of LCD2: Connect the R/W pin of LCD2 to the ground.
- Connect RS and E pins of LCD2: Connect the RS and E pins of LCD2 to the RA5 and RA6 pins of U1 respectively.

7.3. Programming the PIC AT89C51 Microcontroller with Keil uVision5

- Click project => New uVission Project.
- Next, choose the direction that you want to save the project.

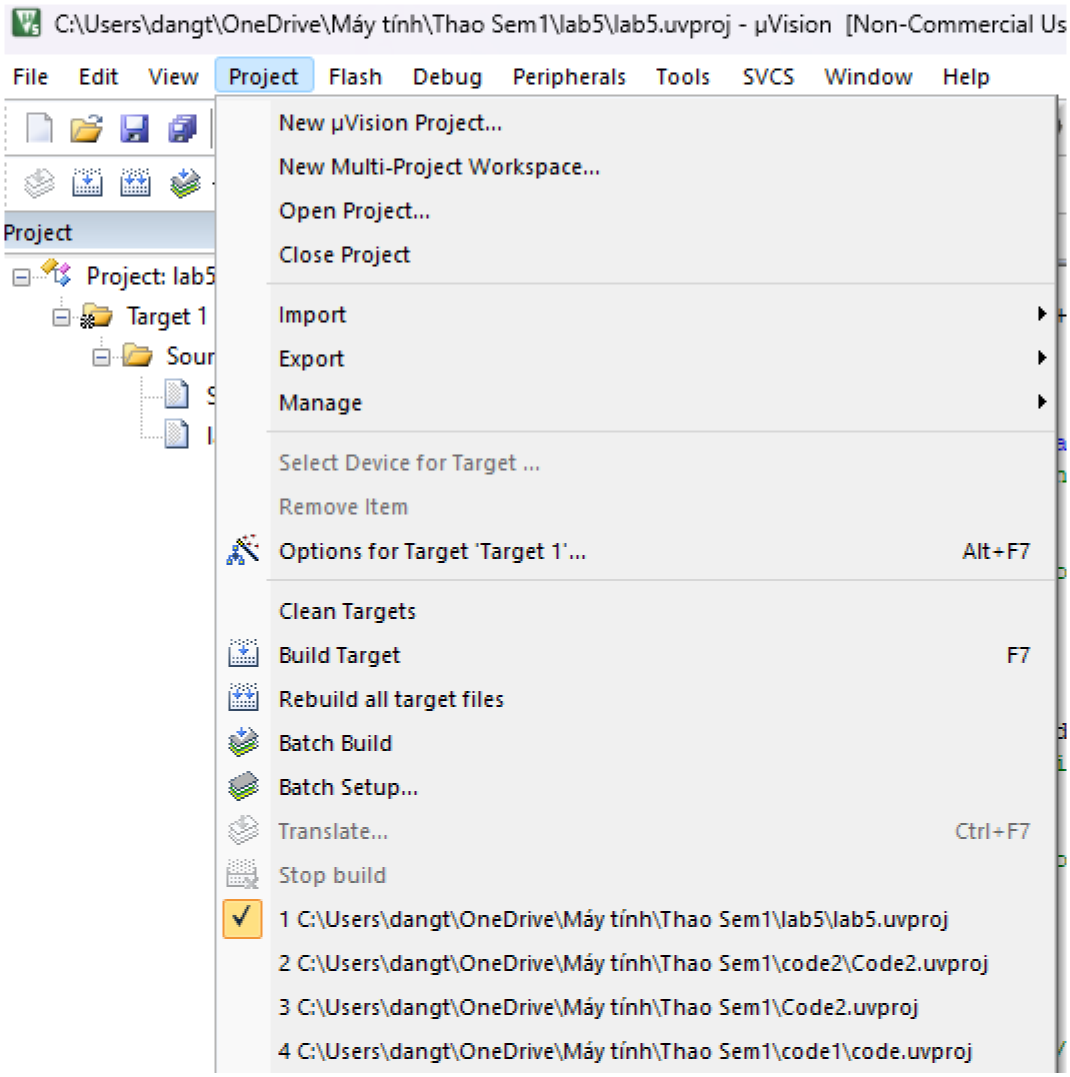


Figure 16 New uVision project

- After creating a project, it will appear a Select Device
- At the first field, insert AT89C51 the microcontroller that we chose for the project, and then, click the OK button

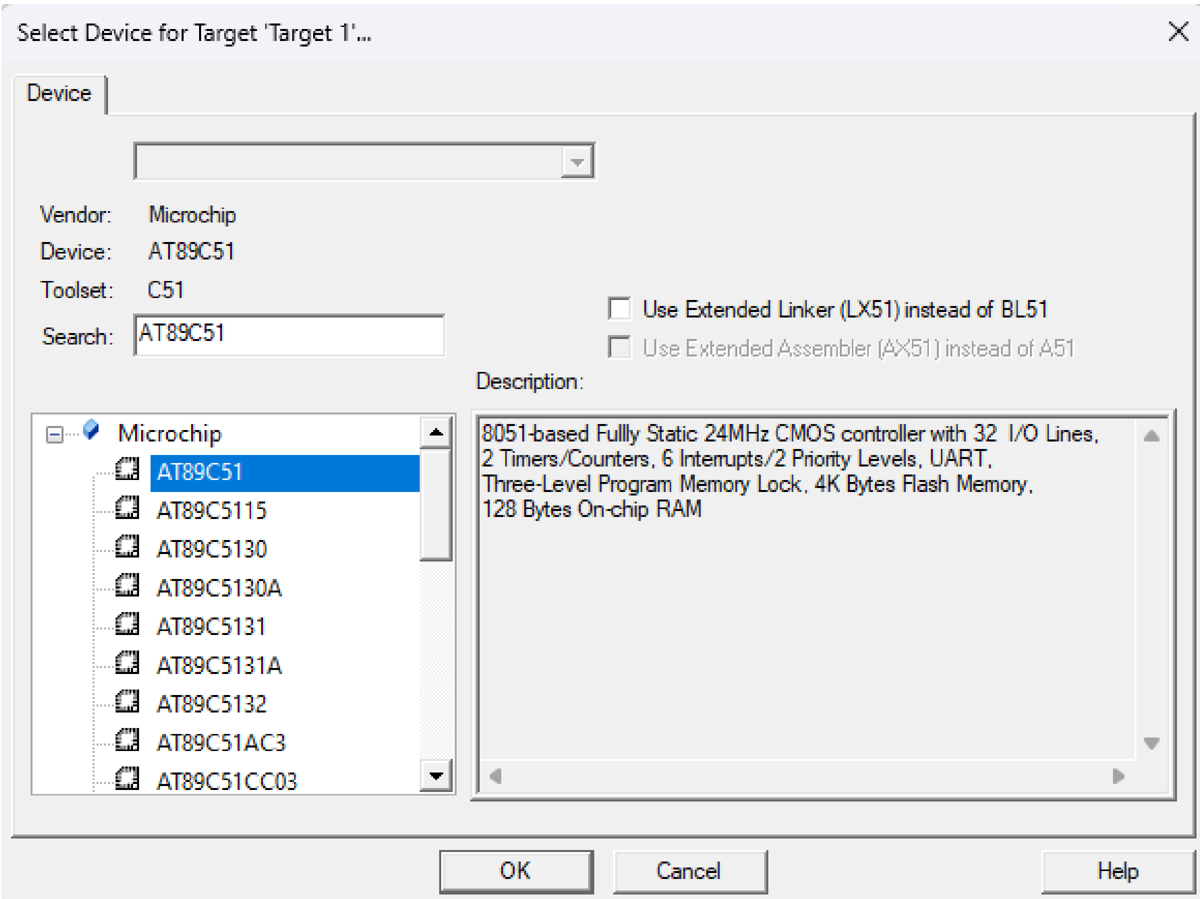


Figure 17 Select Device AT89C51 in Keil uVision5

- Next, right-click on the mouse and then choose "Option to target", it will appear above
- Click on the Output option and tick to Create HEX file. That option will have an impact in the case when you build a project, it will render the C-code to a Hex file (that is used when running simulations in the proteus)

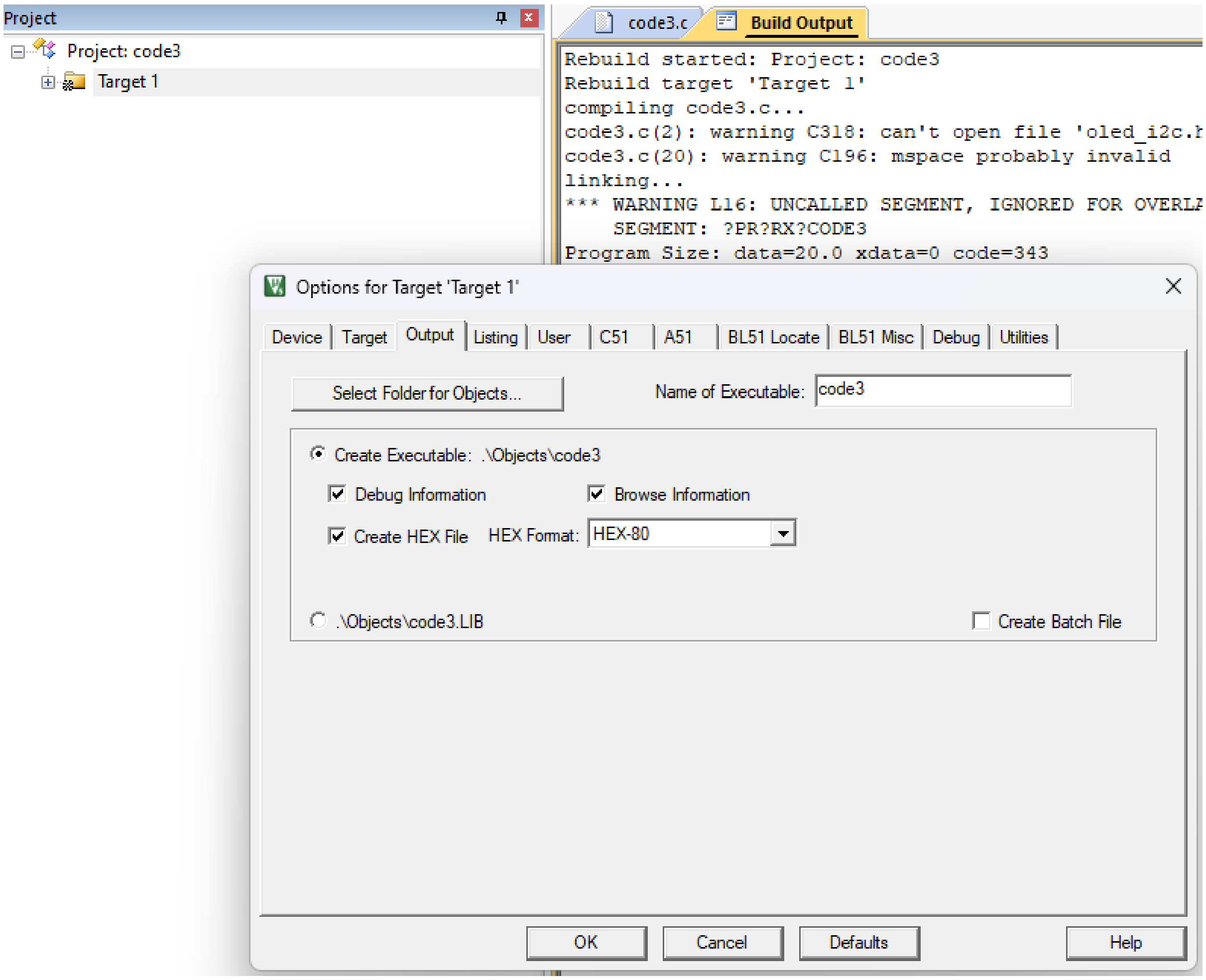


Figure 18 Hex file in Keil uVision5

- Last before go to the code, right click on the target option and choose "Option to target" one again then click "Target" option. Here, changes the value in the X tall box to 11.0592 because the frequency of 11.0592 MHz is a standard frequency commonly available in crystal oscillators. It's a multiple of 1.8432 MHz, another commonly used frequency.

- When all setting is complete done, let create a C-file to write, build and simulation.
  1. Click "New" on the header of enter ctrl + N on the keyboard to create a new text file.
  2. Save that new file and insert it below Source Group 1 folder and named it is code3.c (or other name but must have .c at the end)

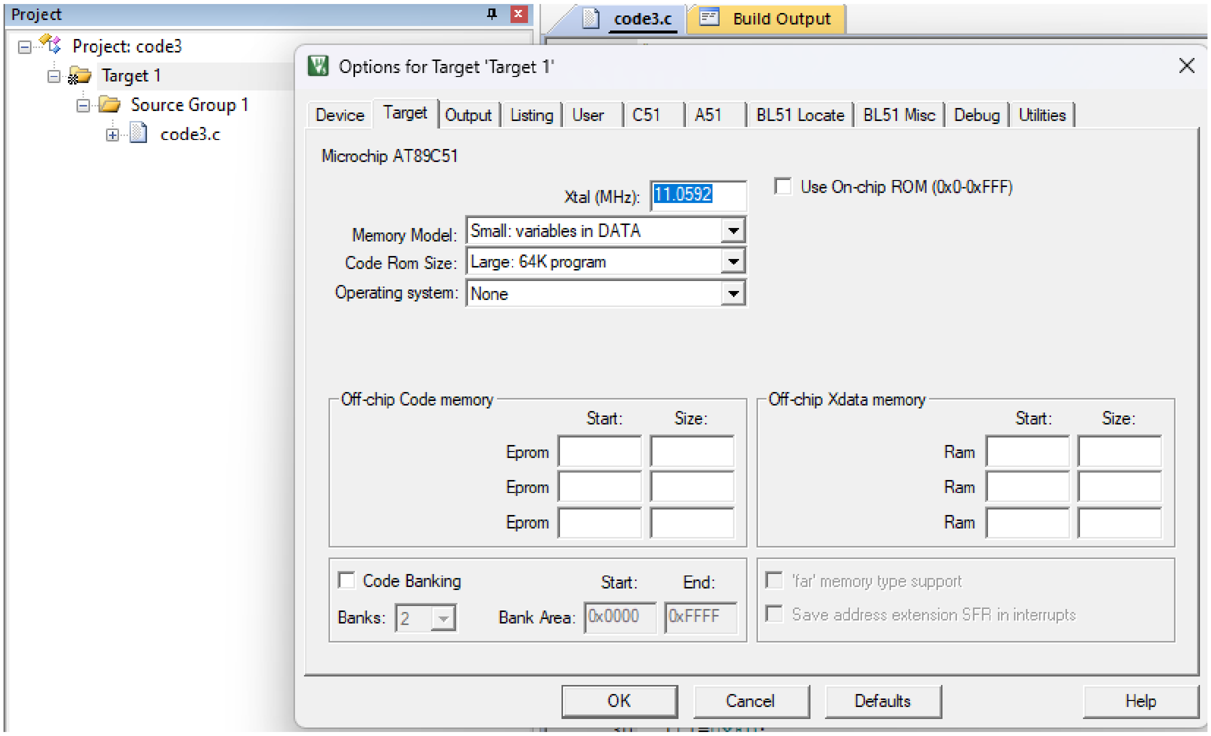


Figure 19 Build source code

- Write code in the file[1]

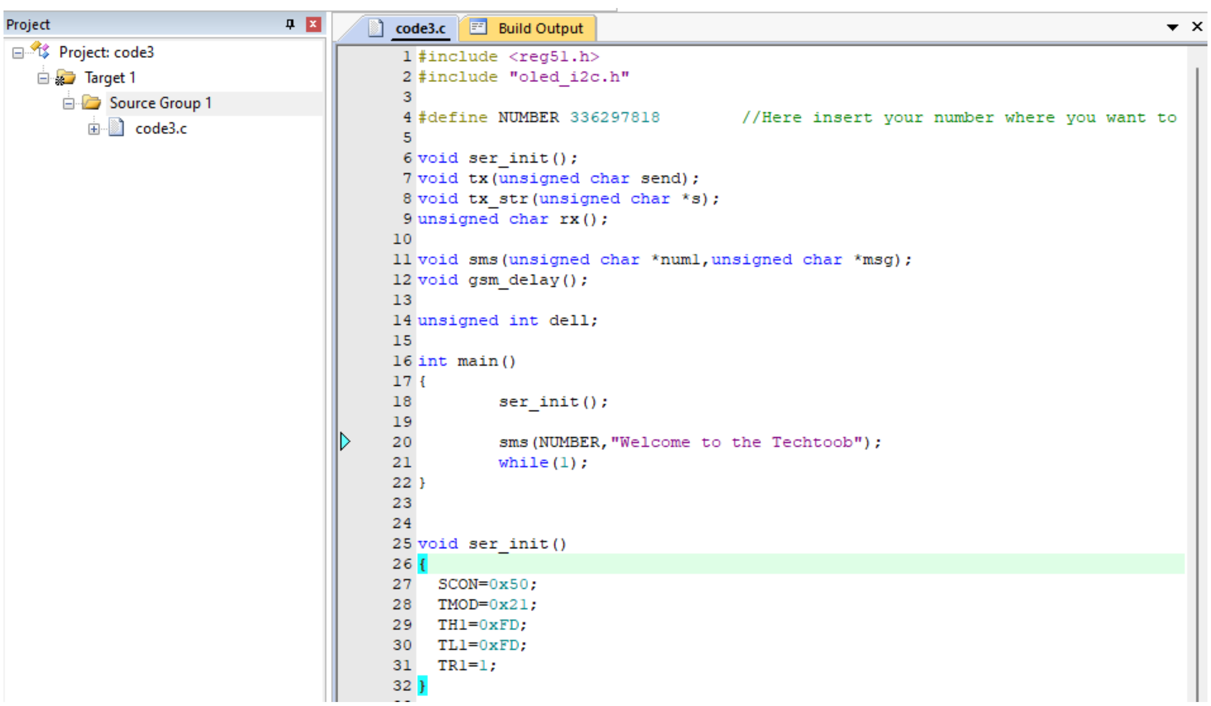


Figure 20 Write code in the file

[1] In appendix part

- Translate and build the project (at the header) until no error exists anymore.

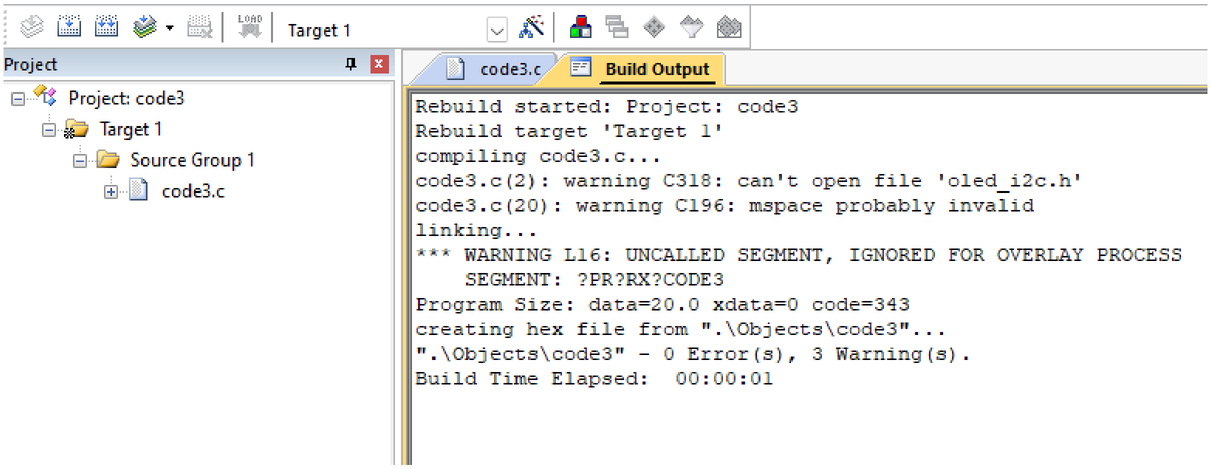


Figure 21 Translate and build the project

- Then at the folder where you save the project, it's have code3.hex file.

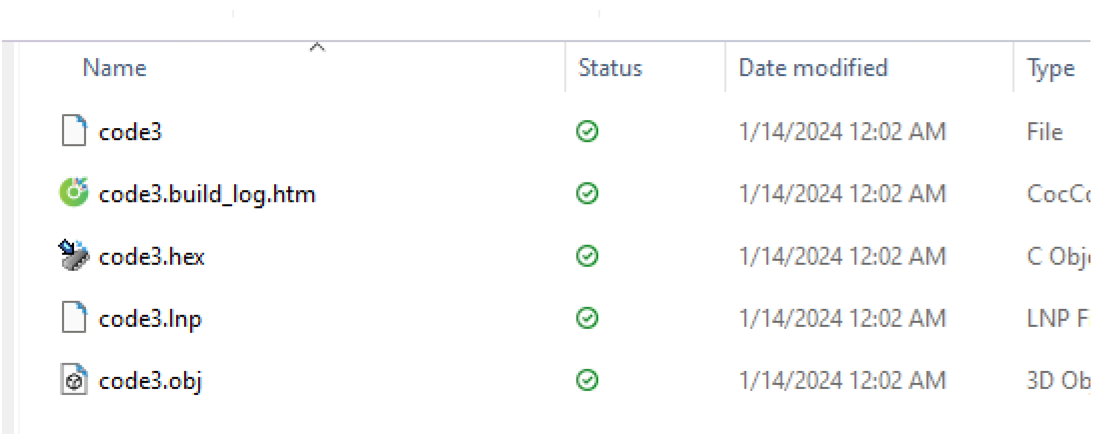


Figure 22 Code.hex

- Open Proteus and embed the code into the AT89C51 Microcontroller. Allow change of the clock frequency to 11.0592MHz.

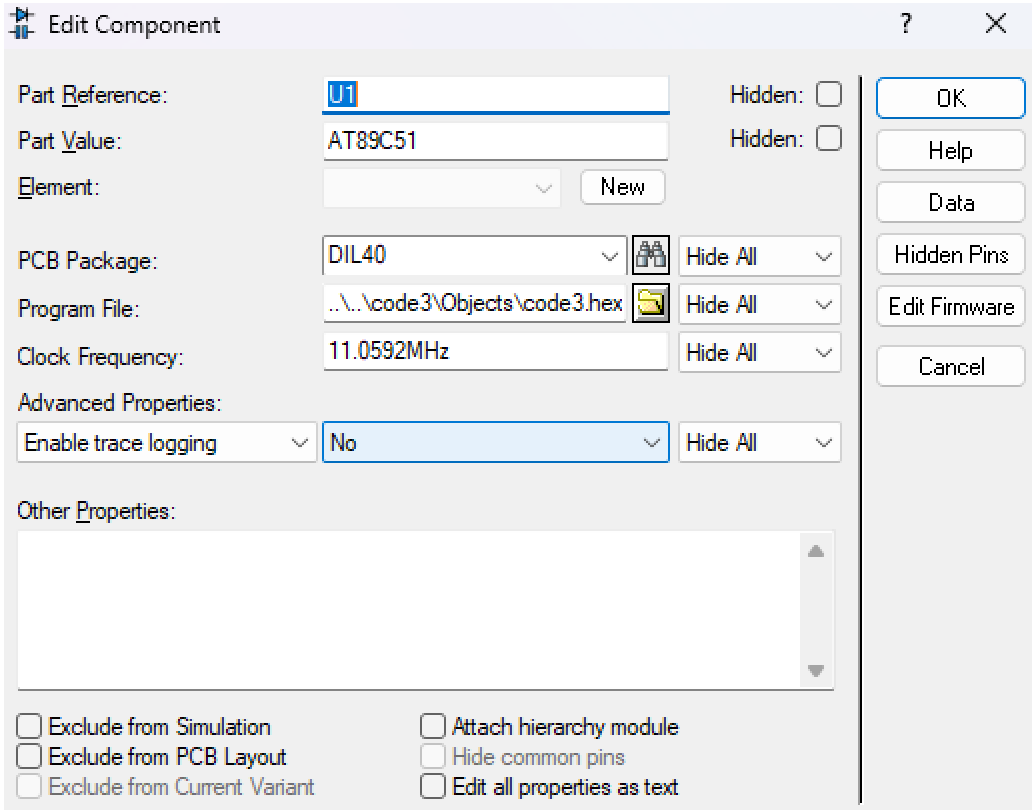


Figure 23 Embed code

- Virtual terminal

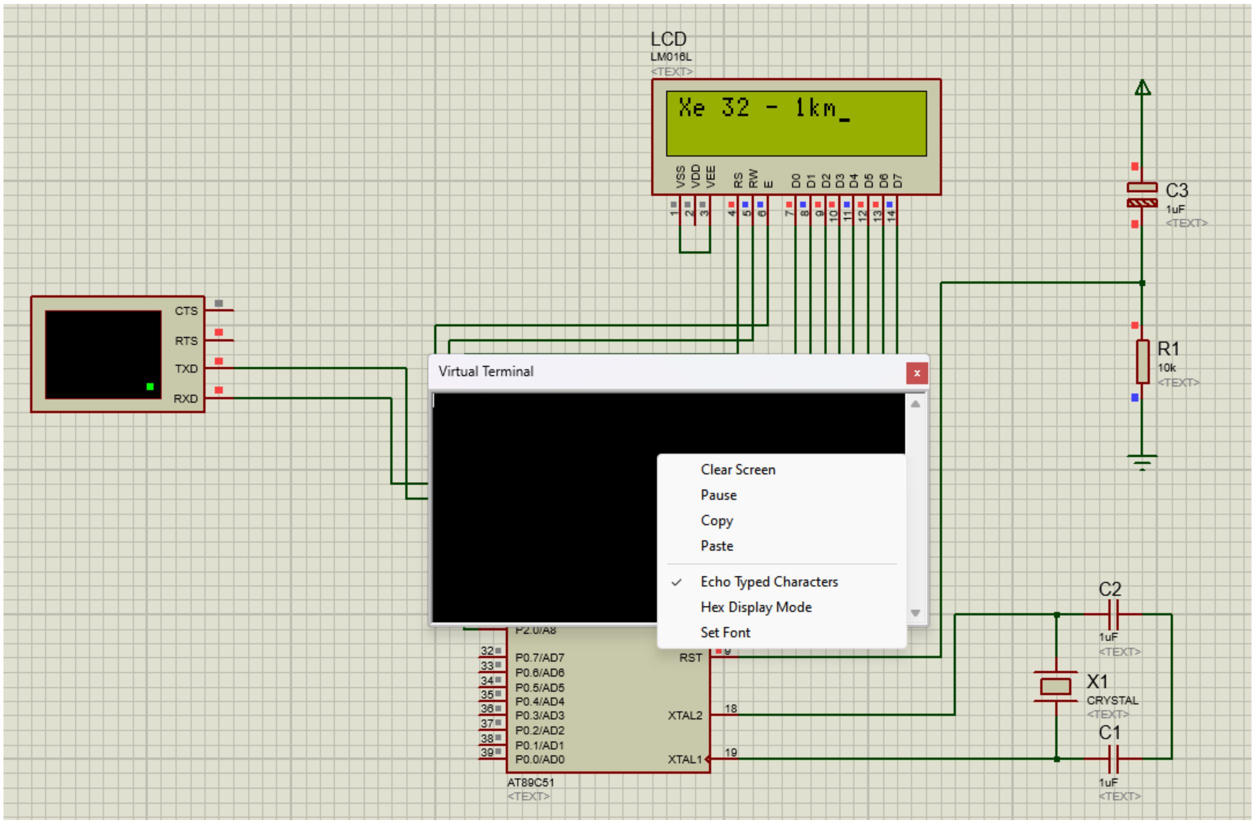


Figure 24: Virtual terminal

- When you run the simmulation a virtual terminal will appare. Here, you can write something that you want to display in the LCD
- Write text in terminal and get the result.

7.4. Result

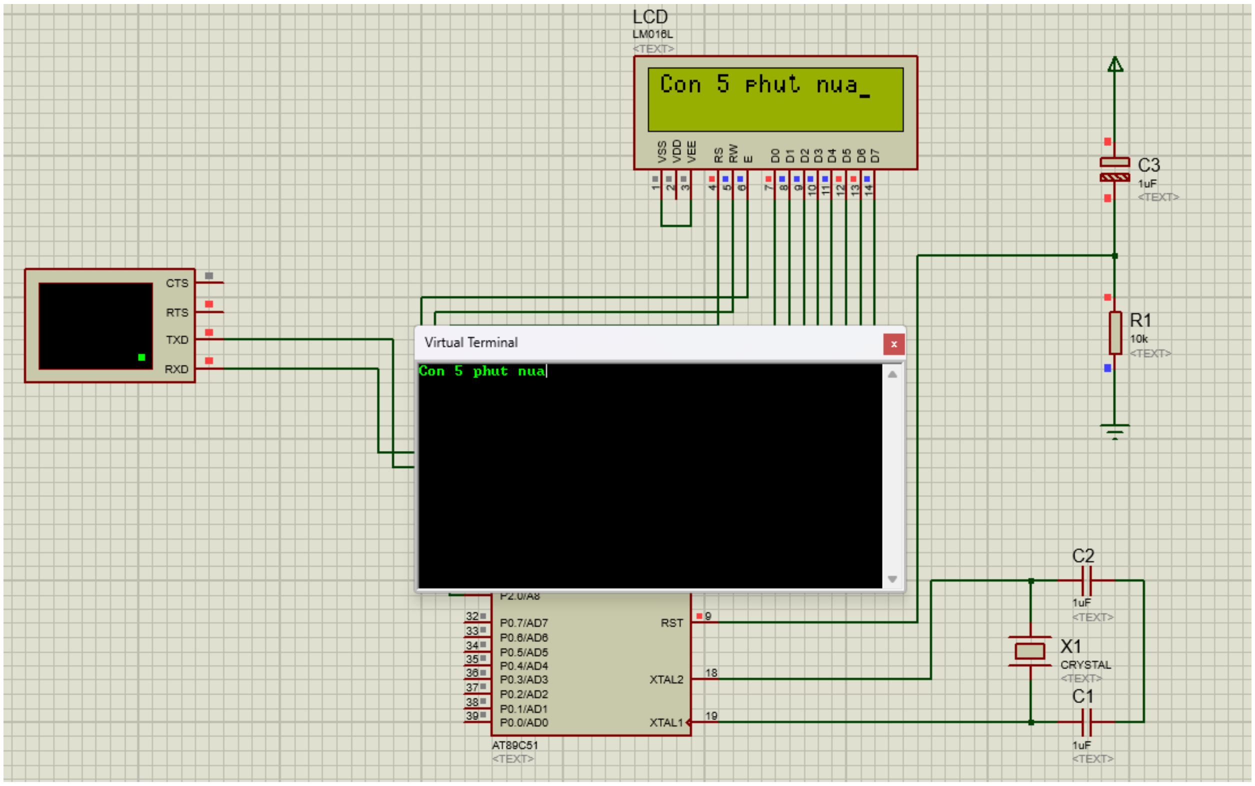


Figure 25 Result of the project

- There is a microcontroller (U1) in the center with multiple pins connected to other components and labeled accordingly.
- Components like capacitors (C1, C2, C3), crystal oscillator (X1), and resistor (R1) are visible and connected to the microcontroller.
- There's an LCD on the left side labeled "LCD1" with connections leading to it.
- A black rectangle on the right side might represent another component or module but is not labeled.
- Vietnamese text is present near the LCD display indicating some kind of message or instruction. The text reads: "Xe 321* 22km, 5 phut nua toi".

7.5. Effectiveness and Applicability Evaluation

7.5.1. System performance

Objective: Evaluate the system's performance concerning its responsiveness, data accuracy, and real-time update capabilities.

Methodology: Conduct rigorous testing, utilizing simulated scenarios in Proteus to assess how well the system handles diverse information updates and user interactions.

7.5.2. User Experience

Objective: Gauge the overall user experience by considering the intuitiveness of the interface, ease of navigation, and responsiveness to user inputs.

Methodology: Engage end-users in a controlled environment, gather feedback, and analyze user interactions using Proteus and Keil uVision5 to implement necessary enhancements.

7.5.3. Reliability and stability

Objective: Assess the system's reliability and stability under varying conditions, ensuring it can consistently deliver information without disruptions.

Methodology: Implement stress testing within Proteus, simulating scenarios with increased data loads and environmental variables to observe how well the system maintains stability.

7.5.4. Practical Applicability

Objective: Examine the extent to which the Wireless Electronic Notice Board meets real-world needs and addresses the identified problem in public transportation.

Methodology: Deploy the system in a controlled practical environment, mimicking a bus station scenario, and gather feedback from both end-users and administrators.

7.5.5. Adaptability and Scalability

Objective: Evaluate the system's adaptability to different settings and its scalability to accommodate potential future expansions.

Methodology: Use Proteus to simulate various environments and configurations, assessing how well the system adapts, and explore the potential for scalability.

7.5.6. Integration with External Systems

Objective: Explore the system's capability to seamlessly integrate with external data sources or management systems.

Methodology: Simulate integration scenarios in Proteus, testing the interoperability of the Wireless Electronic Notice Board with external systems.

7.5.7. Cost-Effectiveness Analysis

Objective: Conduct a cost-effectiveness analysis to evaluate the economic feasibility of implementing the system in real-world scenarios.

Methodology: Consider development costs, maintenance expenses, and potential savings or benefits derived from the system. Utilize financial models within Keil uVision5 for cost analysis.

VIII. Project Cost

8.1. Labor Cost

- Đặng Phương Thảo
  1. Hours Worked: 25 hours
  2. Rate: 20,000 VND/hour
  3. Cost: 25 x 20,000 = 500,000 VND
- Nguyễn Minh Hoà
  1. Hours Worked: 25 hours
  2. Rate: 20,000 VND/hour
  3. Cost: 25 x 20,000 = 500,000 VND
- Trần Hải An
  1. Hours Worked: 25 hours
  2. Rate: 20,000 VND/hour
  3. Cost: 25 x 20,000 = 500,000 VND

Total Labor Cost

500,000 VND (Đặng Phương Thảo) + 500,000 VND (Nguyen Minh Hoa) + 500,000 VND (Trần Hải An) = 1,500,000 VND

8.1. Labor Cost	**Hours Worked**	**Rate (VND/hour)**	**Cost (VND)**
Đặng Phương Thảo	25	20,000	500,000
Nguyen Minh Hoa	25	20,000	500,000
Trần Hải An	25	20,000	500,000
Total Labor Cost	-	-	1,500,000

Table 3 Labor cost

8.2. Equipment Cost

- SIM900A

Cost: 800,000 VND

- MicroController AT89C51

Cost: 200,000 VND

- LCD

Cost: 2,000,000 VND

- Other Costs (Photocopying, Incidental)

Cost: 400,000 VND

- Total Equipment Cost:

800,000 VND (SIM900A) + 200,000 VND (MicroController AT89C51) + 2,000,000 VND (LCD) + 400,000 VND (Other Costs) = 3,400,000 VND

8.2. Equipment Cost	**Cost (VND)**
SIM900A	800,000
MicroController AT89C51	200,000
LCD	2,000,000
Other Costs (Photocopying, Incidental)	400,000
Total Equipment Cost	3,400,0000

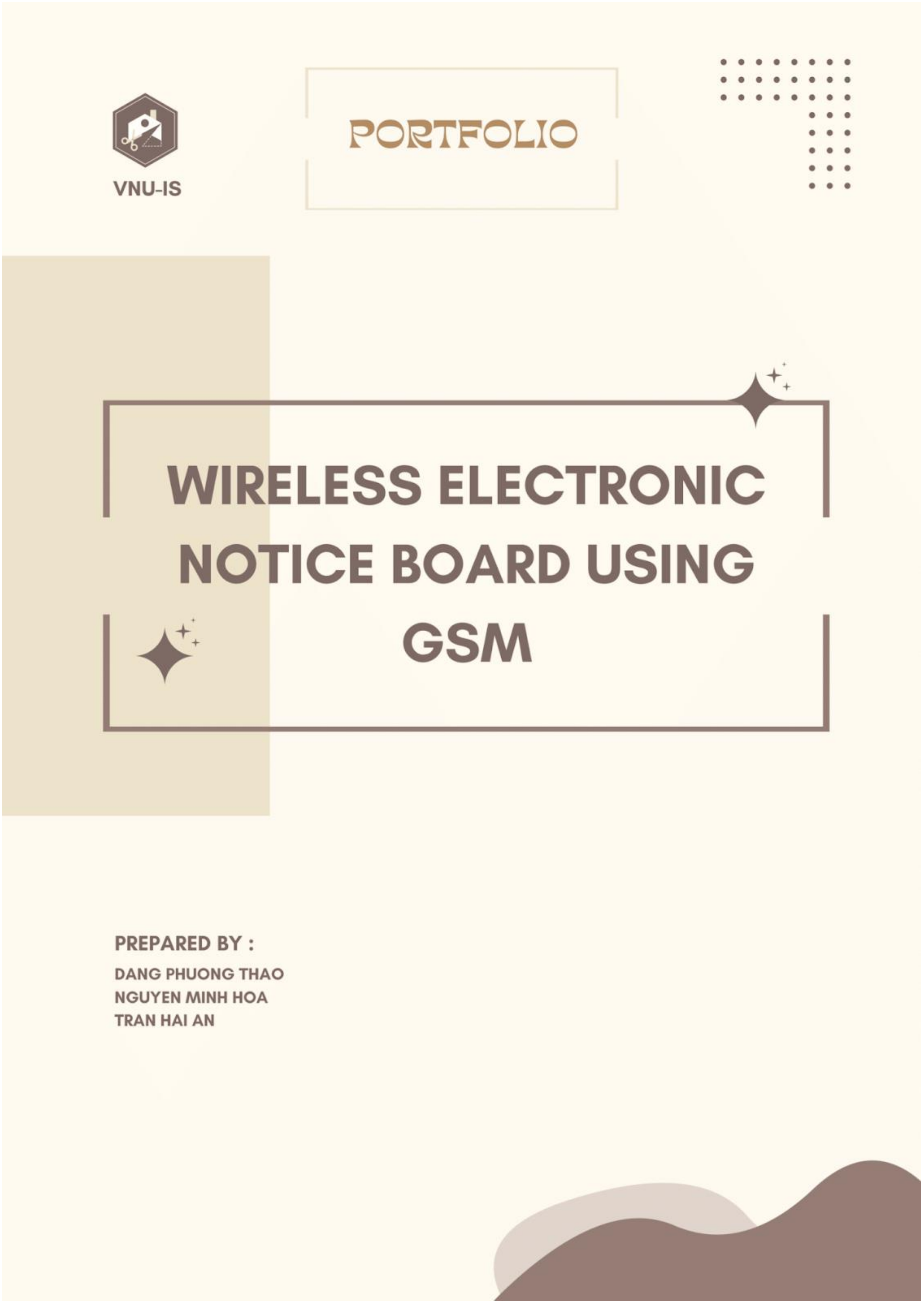
Table 4 Equipment cost

8.3. Total project code

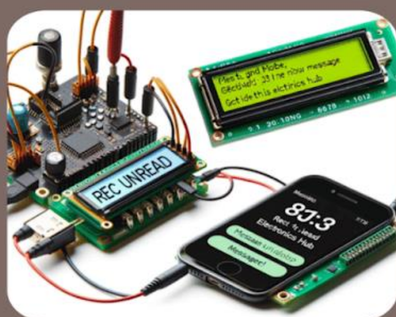
Labor Cost + Equipment Cost:

1,500,000 VND (Labor Cost) + 3,400,000 VND (Equipment Cost) = 4,900,000 VND

IX. Portfolio



INTRODUCE



Description: This project focuses on creating a wireless electronic notification system using GSM to display important information at bus stops. The system uses a large LED panel to display essential messages and information to passengers.

Main function:
Displays notifications and shipping information.
Update information remotely via GSM.
Integrate with monitoring systems to track schedules and traffic conditions.

TECHNOLOGY AND EQUIPMENT

PROTEUS

USE PROTEUS TO CONTROL THE LED PANEL AND COMMUNICATE WITH THE GSM MODULE.

KEIL UVISION5

USED TO DEVELOP AND DEBUG SOURCE CODE FOR EMBEDDED MICROCONTROLLERS, COMPILE CODE TO MACHINE CODE, AND MANAGE EMBEDDED PROJECTS.

GSM MODULE

GSM MODULE HELPS CONNECT AND TRANSMIT INFORMATION REMOTELY.

LED BOARD

USE A LARGE LED BOARD TO DISPLAY MESSAGES.

PRICE INFORMATION AND INCENTIVES

Original product price	4.900.000
Buy from 5 products get 5% off	4.655.000
Buy from 10 products get 15% off	4.165.000
Buy more than 15 products get 20% off	3.920.000

Applies to the first 100 products in the store

THANK YOU

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Electronicgms.com

X. Conclusion

10.1. Summary of the Project

In summary, the "Wireless Electronic Notice Board using GSM" project has successfully addressed the challenges in public transportation, providing an innovative solution to enhance information dissemination and improve the overall passenger experience. The project involved the design and assembly of hardware components, the development of an application utilizing GSM technology, rigorous testing, and a comprehensive evaluation of its effectiveness and applicability.

Key Achievements:

- Creation of a wireless electronic notice board for bus stations, offering accurate and detailed information on bus schedules and arrival times.
- Optimization of traffic management and public transportation through real-time traffic updates and effective resource coordination.
- Time and stress reduction for passengers by facilitating efficient trip planning and minimizing uncertainties associated with public transportation.
- Enhanced flexibility and quick response capabilities, adapting seamlessly to schedule fluctuations and emergency traffic situations.
- Encouragement of public transportation use and environmental protection by reducing traffic congestion and supporting sustainable living.

Potential Applications:

The project's versatility extends beyond public transportation, with potential applications in education, healthcare, culture, and various other sectors.

10.2. Future Development and Improvements

The success of the project paves the way for future development and improvements. Opportunities for expansion and collaboration include:

- Integration with mobile applications for travel scheduling and management.
- Connection with smart traffic management systems to optimize routes and reduce congestion.
- Exploration of partnerships and collaborations for broader market reach.

Additionally, future developments may include the integration of Text-to-Speech (TTS) features. This enhancement aims to provide an auditory dimension to the system, further improving accessibility and user engagement.

The project aligns with the digital transformation trend, contributing not only to improved service quality but also to the development of smart cities, where public services are digitized for enhanced convenience and a higher quality of life.

10.3. Acknowledgements

We extend our heartfelt gratitude to all those who supported and accompanied us throughout the project's implementation. Special thanks to our team members, mentors, and collaborators for their invaluable contributions. We also express appreciation to potential partners and customers, anticipating their interest and cooperation in bringing our product to a wider market.

In conclusion, the success of the project goes beyond the tangible product; it lies in the journey of research, development, and completion. The practical skills gained, understanding of market dynamics, and effective teamwork are valuable experiences that serve as the foundation for future research and development endeavors.

We look forward to continued support and collaboration in our future endeavors, believing that the impact of our project extends beyond its immediate application to contribute to the broader landscape of technological innovation and societal development. Thank you for following our journey.

XI. Estimate time and detailed task for each member of project

No	Main task	Subtask	Worker	Time estimate
1	Simulation	Draw circuit	Nguyen Minh Hoa	2 days
			Tran Hai An	2 days
			Dang Phuong Thao	2 days
		Code	Nguyen Minh Hoa	2 days
			Tran Hai An	2 days
			Dang Phuong Thao	10 days
2	Report	Project Information	Dang Phuong Thao	1 day
		Introduction about project	Nguyen Minh Hoa	1 day
		Methodology and Milestone	Tran Hai An	1 day
		Milestone and timeline	Dang Phuong Thao	1 day
		Project outcome	Dang Phuong Thao	1 day
		Project cost	Nguyen Minh Hoa	1 day
		Conclusion	Dang Phuong Thao	0.5 day
			Tran Hai An	0.5 day

		Reference	Dang Phuong Thao	0.5 day
			Tran Hai An	0.5 day
3	Work evidence	Work evidence	Dang Phuong Thao	1 day
			Nguyen Minh Hoa	1 day
			Tran Hai An	1 day
4	Portfolio	Portfolio	Nguyen Minh Hoa	0.5 day
			Tran Hai An	0.5 day
5	Slide and presentation	Slide and presentation	Dang Phuong Thao	2 days
			Tran Hai An	2 days
			Nguyen Minh Hoa	2 days

Table 5 Estimate time and detailed task for each member of project

XII. Appendix

```
#include <REGX51.H>

#include <stdio.h>

#include <LCD_lib.H>

#include <string.h>


// Function prototype for print_str

void print_str(const unsigned char *str);

void uart_init();

char uart_receive();


void delay(unsigned int time) {

    while(time--) {

        int k = 121;

        while(k--){}

    }

}


void main() {

    // Variable declarations

    unsigned char i;

    unsigned char str[30] = "Xe 32 - 1km"; // Initialize with "Hello World"

    bit flag = 1; // Set the flag to 1 initially to print the string

    unsigned char *p;
```

```
// Initialization functions
setting();
uart_init(); // Initialize UART

// LCD function to set the cursor to the home position
home();

p = &str[0]; // Initialize a pointer to the beginning of the string

// Infinite loop
while(1) {
    // Print the string on the LCD if there was a change
    if (flag) {
        print_str(str);
        delay(400);
        flag = 0;
    }

    // Check if there is data received via UART
    if (RI) {
                                            printf("OK");
        RI = 0; // Reset receive interrupt flag
        *p = uart_receive(); // Receive character from UART
        p++;
        flag = 1; // Set the flag to update the LCD
```

```
        }
    }
}

// Function to initialize UART
void uart_init() {
    TMOD |= 0x20; // Set Timer 1 to 8-bit auto-reload mode
    TH1 = 0xFD;   // Set baud rate to 9600 (for a 12MHz crystal)
    TL1 = 0xFD;
    TR1 = 1;      // Enable Timer 1
    SCON = 0x50;  // Set serial mode 1 (8-bit UART)
    TI = 1;       // Set transmit interrupt flag
}

// Function to receive a character from UART
char uart_receive() {
    while (!RI);  // Wait until a character is received
    RI = 0;       // Reset receive interrupt flag
    return SBUF;  // Return received character
}
```

References

[1] "moving message display on LCD using 8051 microcontroller.," *Aticleworld.*

https://www.engineersgarage.com/at89c51-microcontroller/

https://www.scribd.com/document/239799195/moving-display-using-8051-micro-controller

https://circuitdigest.com/microcontroller-projects/wireless-notice-board-using-gsm-and-arduino