Security system project

Discussed with Dr. Hossam El-Din Ali

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Introduction

Welcome to the exciting world of embedded systems! In this project, we delve into the realm of designing and developing a cutting-edge embedded system. An embedded system is a combination of hardware and software that is specifically designed to perform dedicated functions within a larger system. These systems are all around us, from our smartphones and smartwatches to our cars and home appliances.

In this project, we aim to create an innovative embedded system that addresses a specific problem or fulfills a particular need. We will explore the intricacies of hardware design, software development, and system integration to bring our idea to life. Throughout the process, we will encounter challenges, make critical design decisions, and learn how to optimize performance and efficiency.

Therefore, we began developing our system using an AVR microcontroller rather than an Arduino in order to use it more effectively. We also used our own drivers rather than built-in libraries to make it more generic to all microcontrollers and to give us the freedom to modify the functions we created to suit the purposes for which we are using it. Furthermore, we utilized several external hardware elements, such as an ultrasonic sensor, a keypad, a Bluetooth module, a temperature sensor, a servo motor and LCD display

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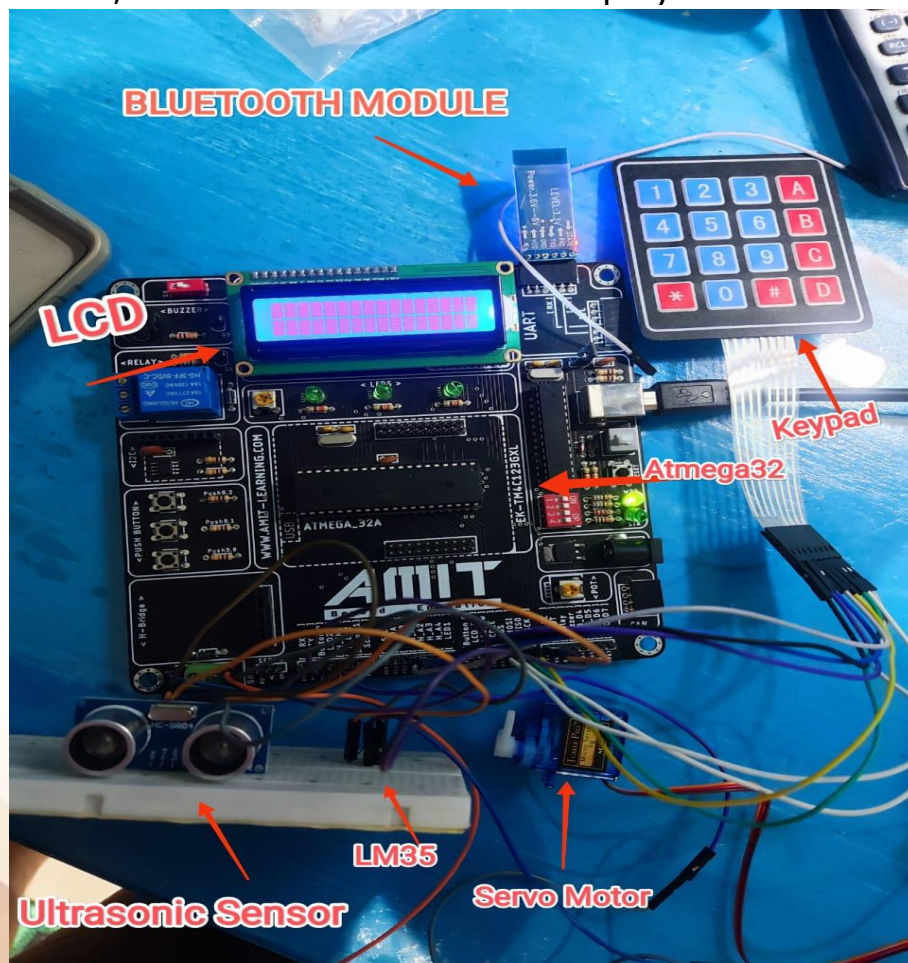
First module

Password setter & checker

Therefore, in order to discuss security, we must limit access to a select group of individuals, such as administrators, managers, and CEOs. And for that reason, we naturally started by creating a two-step password checker and setter. We have programmed a function that requests the user's password and determines whether it is appropriate in terms of length and character count. The user then enters his previous password so that we may verify its length and character usage once more before comparing it to the password stored in memory. Furthermore, he only gets two chances to try again before the system locks everything and activates the alert system using a buzzer component and a led. And if it's the right password, we use a servo motor component to unlock the door for him. All of that information is written in a memory-saving and effective way.

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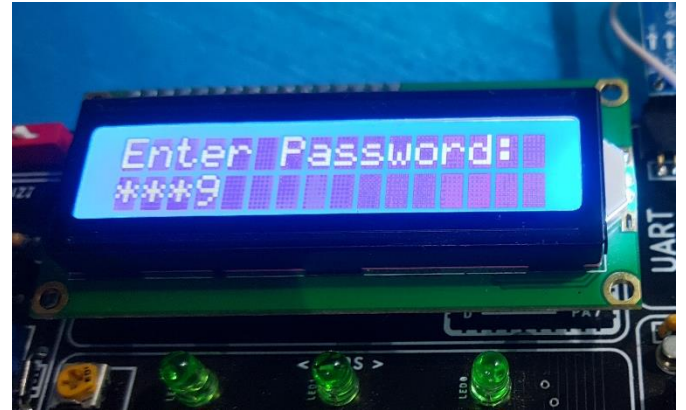
second module

temperature displaying & adjusting environment

Here, we began using the analog-to-digital converter (ADC), one of the AVR's peripherals. Which used to take the temperature sensor signal and convert it to binary data so that the microcontroller could understand it, and we discovered the mathematical equation to get the correct calculation for temperature and display it on the LCD on an infinity loop to refresh it roughly every 62.5 Nano seconds according to the AVR frequency. All of that is written in an optimized and memory-saving

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Third module

calculator

As a result, business people need a calculator in order to figure up their revenue and profit, which is why we included one in our security system. Despite wireless delays and mistakes, we integrated a keypad component and made advantage of the LCD display to give you the best response possible. It is a straightforward calculator that makes use of as little code and memory as is practical.

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Fourth module

Parking sensor and alert

You may have just gotten here from work or are already there. And you're parking your car but holding your phone and not paying attention, we have the solution for you. Our parking system tells you the exact distance and alerts you when you get too close even through your phone so it can be easily seen for you using an ultrasonic sensor and also an ADC channel to convert the signals and also refreshes every 62.5 nanoseconds in accordance with the AVR frequency. We have also conducted a mathematical equation for its conversion and it is also visible to you on the LCD.