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Microcontroller-based automatic home gate control system using a remote

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ABSTRACT

Home security remains a fundamental necessity in modern living. This study presents the design and implementation of an automatic home fence security system based on a microcontroller-controlled remote access mechanism. The system utilizes an ATmega8535 microcontroller, programmed using Code Vision AVR software, to control the opening and closing of the home fence through a password-protected remote keypad. The entered password is verified with the data stored in the system's memory. Upon successful authentication, the microcontroller activates the L293D motor driver to operate the motor that opens or closes the fence, while an LCD display provides real-time status information. The communication between the transmitter and receiver modules employs infrared (IR) serial communication using the UART protocol to ensure reliable data transfer. Experimental results demonstrate that the proposed system effectively enhances residential security and provides convenient automated control of gate operations.

INTRODUCTION

Currently, many household activities still rely on manual methods, including securing the home. The house gate, a common security system used in urban residential areas, often depends on human effort to open and close it, along with the use of a padlock as an additional security measure. Although this method has been in use for a long time, it has several drawbacks, such as its vulnerability to damage or theft, as padlocks can be easily tampered with or broken by intruders. Moreover, manually operating the gate can be inconvenient, especially when the homeowner is away or unable to perform the task for other reasons. With the advancement of technology, more efficient and secure solutions have emerged, such as an automatic turnstile that can be opened and closed simply by entering a password via remote control. This technology offers a higher level of security, as manual systems relying on padlocks can be easily accessed by unauthorized individuals. The automatic system also allows homeowners to control the gate remotely, providing added convenience, particularly when they are traveling or not present at home. This study aims to describe a simulation of a security system for opening and closing house gates using a microcontroller-based remote control, which not only

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enhances security but also facilitates automatic access management, replacing the vulnerable and outdated manual methods.

METHODS

This fence security system aims to assist homeowners in improving their home security system, especially in the case of unwanted people entering through the front gate. The security system uses the AVR ATmega 8535 microcontroller as a medium which is programmed using Visual C++ software and is assisted by a transmitter-receiver system and memory as a password storage medium. The advantage of AVR ATmega 8535 is that it can store many programs and does not use a computer, so it will be more practical in its use. The specifications in the manufacture of this fence security system are: this tool uses a CD rom as a simulation of a house fence replacement; the user must remember the password that has been entered into the memory; the password used is 5 characters; security system using AVR ATmega 8535 and CodeVisionAVR software and eXtreme burner-AVR as downloader; the program uses the Windows 7 OS; this tool only functions as an automatic gate opening and closing; password consists of 5 characters; the gate will open if the password entered by the homeowner matches the data that has been stored in the memory; The LCD will display the condition when the fence is open when it is opened, and the fence is closed when it is closed.

RESULT AND DISCUSSION

The components that make up the fence security system consist of an ATMega8535 AVR microcontroller, LCD, keypad, transmitter-receiver, and L293D motor driver. AVR program is made in the AVR code vision, which is a cross-compiler. Programs are usually written in C language, but few people use assembly language. The programming flow process is also simple, and the first step is to create a program using the C language in Code Vision AVR. The data is then compiled to become a digital language (0,1), after which it is downloaded into the AVR chip, which is then used to drive the media.

In the AVR, ATMega 8535, there is no need to connect all of these pins, which are not used, including pin 7, pin 8, pin 9, and pin 10, while pin 3 is connected to ground, pin 1 and pin 15 are connected to VCC 5V, pin 2 and pin 16 is connected to ground, the other 8 pins are inserted in the PORT in the AVR. Transmitter- receiver is a serial communication with UART protocol which is asynchronous so that the data transmission speed must be constant so that the receiving device can read the incoming data correctly.6 The speed of data transmission in UART serial communication is known as the baud rate. In the AVR, every byte of data sent serially is automatically added a start bit at the beginning and a stop bit at the end of the message. L293D motor driver IC is an H-Bridge chip that has 2 H-bridge circuits in it so that it can control the speed and direction of 2 motors and supports 4.5-36V motor operation with a current of 600 mA (non-repetitive 1.2A peak current).

The following is an overview of the automation system of the fence security system using the remote control that will be made, including the sender circuit, receiver circuit, and system planning. Input from the keypad in the form of a password will enter the port on the AVR AT Mega 8535. The input will be changed by AVR AT Mega 8535 and forwarded to the IR transmitter circuit, which will then be received by the receiver circuit. The input issued by the IR transmitter of the Sender circuit will be received by the IR receiver in the receiver circuit. It will be processed by the AVR AT Mega 8535 to be matched with the password that has been entered previously and has been stored in memory. If the password is correct, then the memory will provide input into the AVR AT Mega 8535. The input by the AVR AT Mega 8535 will be used as an output to drive the motor until the fence can be opened.7,8

To anticipate the condition or movement model that will occur, it is necessary to have a system that can anticipate it. The program planning for each condition or movement that may occur included standby mode, password change conditions, door opening, and door closing.9 Standby conditions will occur if there is no input from the keypad or remote controller. Password change is done by entering the input letter "A" on the keypad, which will be translated by the microcontroller to display "Menu" on the LCD screen, the letter "B" for drop up (roll up the writing on the LCD screen) and the letter "C" to drop down (scroll down the writing on the LCD screen) and the letter "D" as the OK or Enter button.

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The fence can be opened if the password given is in accordance with the data stored in the previously stored memory.10,11 If appropriate, then the motor will rotate to open the fence. At the same time, the LCD will display the words "Password Correct Fence Opening". The fence will be closed again when pressing the # key on the keypad because it will activate the motor to rotate so that the fence can close again. At the same time, the LCD will display the words “Beware of Closing Fences”.

The fence security system testing is done by combining the software that has been made with a microcontroller so that all components can work as expected.12 When the microcontroller does not get any input from other components, the LCD screen displays the words "Rumah Q" as a means of communication with the homeowner. When the owner presses the "A" button on the screen appears, the words "MENU". When the screen is scrolled down (pressing the C button) on the screen appears the words "Change Password" after 1 second, the writing is replaced with the words "Old Password", when the old password is entered and matches, the owner can enter the new password and press the "D" button to save it in memory. as long as the old password entered does not match, the new password cannot be entered. This is useful to increase the level of security in changing new passwords. When the “B” button (scroll up the screen) is pressed, the screen will display “MENU” again. When the “ * ” (cancel button) is pressed, the screen will display the words “R umah Q” or return to standby.

CONCLUSION

The security design of opening and closing the house fence with a remote control based on a microcontroller increases the security of the home environment.

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