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Design And Implementation Of Motor Monitoring Control System In Shrimp ponds In Vietnam

Triet Pham-Minh, Minh Dang-Hoang

Author information:

- Triet Pham-Minh is a lecturer in Electrical-Electronics Department, School of Engineering and Technology, Tra Vinh University
- Minh Dang-Hoang is a lecturer in Electrical-Electronics Department, School of Engineering and Technology, Tra Vinh University

Abstract - The article focuses on the control and monitoring of motors in shrimp ponds, research on devices to control motors remotely, monitoring devices, to bring convenience to farmers in the process of raising. Implementing solutions to control and monitor motors in shrimp farming. From there, the author focuses on ideas, research and implementation of motor control systems in shrimp ponds. Research on application software and hardware suitable for installing and operating equipment and checking operations, thereby helping to monitor the status of the motor during operation, quickly detecting problems when the motor stops suddenly for repair and replacement.

Keywords: Motor control systems, Shrimp ponds, embedded system, Operations.

I. INTRODUCTION

In recent years, along with the international economic integration of Vietnam, the process of applying scientific and technological advances to the agricultural sector in general and aquaculture in particular has had positive developments [1]. Currently, in the Mekong Delta, the aquaculture industry is developing and forming many large-scale industrial shrimp farming models. High-tech shrimp farming is a model that helps increase product productivity by controlling the entire farming cycle, through automatic feeding technology, applying cloud computing technology to control water environment indicators, the farming system is arranged, rearranged reasonably, continuously from the farming pond system, settling pond, water storage pond, waste pond and waste treatment system is gradually taking shape [2]. From the above reality, implementing solutions to control and monitor motors in shrimp farming is extremely necessary and effective. In shrimp farming, damage to operating equipment such as engines is often encountered. If equipment is damaged and not detected and repaired, it can affect shrimp farming activities. Remote monitoring and control of engines via the internet is also a development trend in the 4.0 era [3], so it is necessary to incorporate remote monitoring and control of engines into the shrimp farming process.

II. BUILDING MOTOR MONITORING CONTROL SYSTEM

Implementing the motor monitoring control system is done through the following ideas:

- Remotely turn on/off the 3-phase motor using smart devices.
- Control and monitor the status of the motors.
- Warning when the motor has a sudden stop problem.

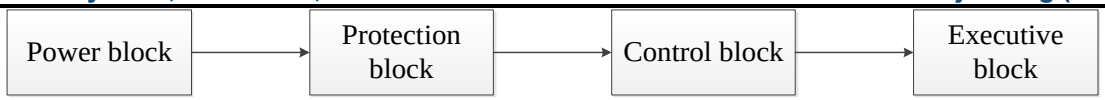


Fig. 1. Control system block diagram [4]

Power block: Power source is an indispensable component and plays an important role in electrical and electronic devices with the function of supplying power to electrical devices. Which power source is being used in the system and which power consuming devices:

DC power source (5VDC): ESP 32, ARDUINO, Relay Module.

AC power source (220VAC): Intermediate relay, Contactor, honeycomb power source.

3-phase power source (380VAC): Phase loss protection, motor.

Protection block: These are switching devices that have the function of automatically cutting off the current when detecting overload, short circuit, overvoltage or electrical leakage.

Control block:

For WIFI mode: Receive program loading from smart devices via Type C port. Control devices via smart devices will be powered and controlled after the program is successfully loaded. The control block will output signals at the Module output.

For Man mode: The intermediate relays control to output the output signal through the contacts of the intermediate relay.

Execution block: This has the task of receiving the output signal of the control block, after receiving the output signal of the control block, the command execution block will close the power supply for the motor to operate.

a) Operating principle

Wifi mode:

The control system uses 5V power from the 220VAC – 5VDC voltage converter to supply to ESP32, Arduino and Relay module.

The switch supplies power to the control circuit using Wifi. When pressing ON from the smart device, it will output a signal, ESP 32 will receive the signal and then output the signal to the controller for processing and output to control the devices behind (at the same time, it will output a signal allowing Arduino to send errors to ESP32). After the signal is output, it will be transferred to the relay module block. When the relay module has received a signal from the relay controller, it will close the contact to supply power to the contactor coil, the contactor's power contact will close to supply power to the motor to operate. When we press OFF from the smart device, the device will output a signal. ESP 32 will receive the signal and then output that signal to the controller for processing, output to control the devices behind (at the same time, ESP32 will stop providing the signal, Arduino will not be able to send an error back). After the signal is output, the relay module will be switched to receive the signal. When the relay module has received a signal from the relay controller, it will open the contact, stop supplying power to the contactor coil, the contactor's power contact will open to stop supplying power to the motor to stop operating. During the motor operation, if the motor suddenly stops, the 2 centrifugal switch contacts will close, the signal is transmitted to the arduino for processing and then outputs the signal to the ESP 32. After the ESP32 receives the signal from the arduino, it will send a signal to the smart device to warn the motor to stop working [5].

Man mode:

The switch supplies power to the manual control circuit. When ON is pressed, the coil of the intermediate relay will be supplied with power, and at the same time, the first pair of normally open contacts of the relay will be supplied with power to maintain the circuit operation. The second pair of contacts will supply power (L) to A1 for the contactor (A2 of the contactor has been connected to the N source) to make the contactor operate, the dynamic contact will close to supply power to the motor to operate. When OFF is pressed, the normally closed contact of the OFF button will open, the coil of the intermediate relay will stop operating, the 2 pairs of normally open contacts will return to the original state, stopping the power supply to the contactor, the dynamic contact will open, the motor will stop operating. When an overload occurs, the bimetallic bar of the thermal relay will contract, opening the control circuit (opening the N source), the contactor will stop operating, the dynamic contact of the contactor will open, the motor will stop operating. When pressing the emergency switch, the circuit will open, stopping the power supply to the control circuit in manual mode and wifi mode.

b) Control devices

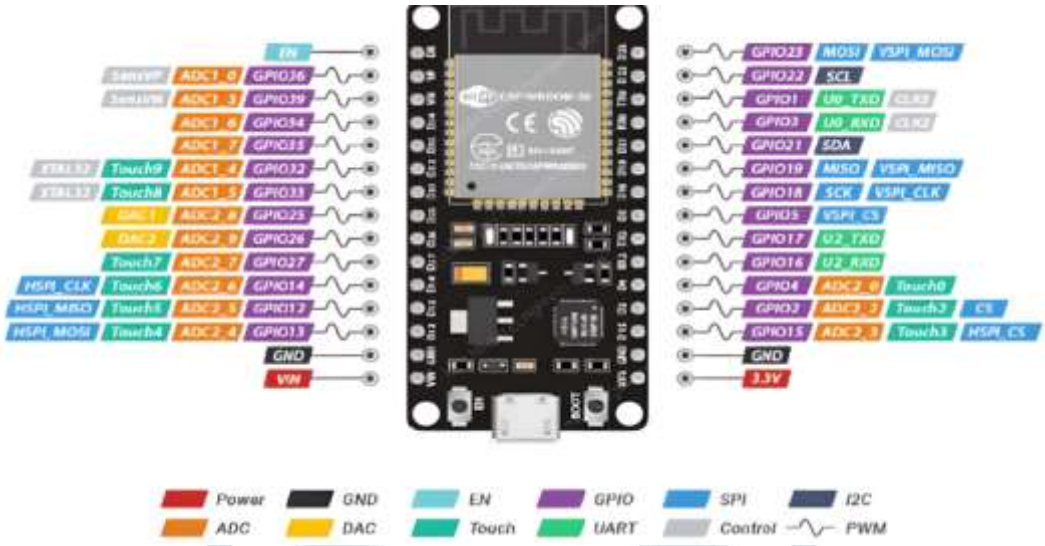


Fig. 2. ESP32 tasks

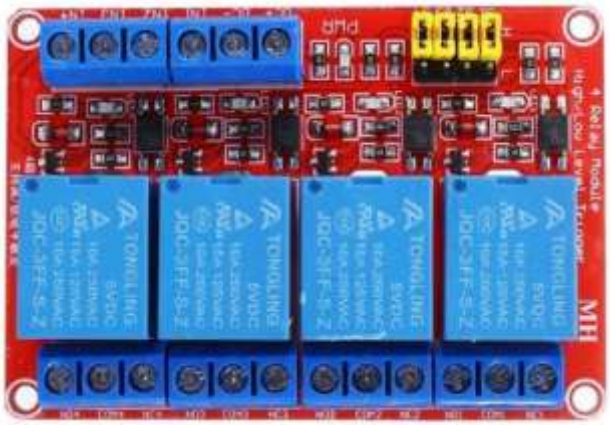


Fig. 3. Relay module H/L trigger level



Fig. 4. Arduino Uno R3 Board

c) Control software

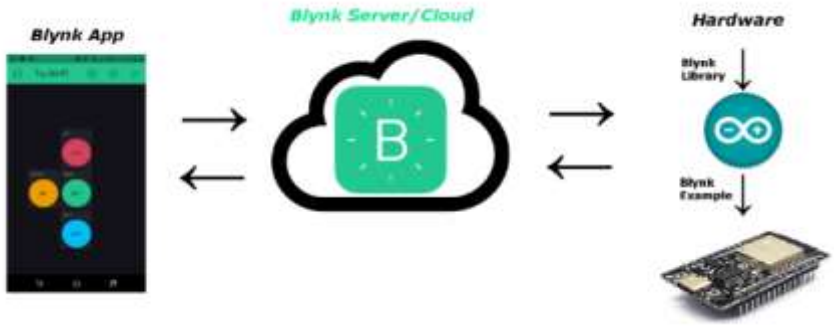


Fig. 5. Blynk smart connectivity app

How to install the blynk application:

You can install the Blynk application on Andoird or on IOS

Step 1: on your smartphone, download and install the blynk application from the link.

App download link:https://m.apkpure.com/p/cc.blynk

Step 2: Create an account on the Blynk App for yourself using your personal email to get confirmation, this is the code used to link the program and hardware.

Next, we create a new project and name the project. Then, select the type of ESP to use. When the project is successfully created, Blynk will provide us with a setup code to connect to the Blynk Server.

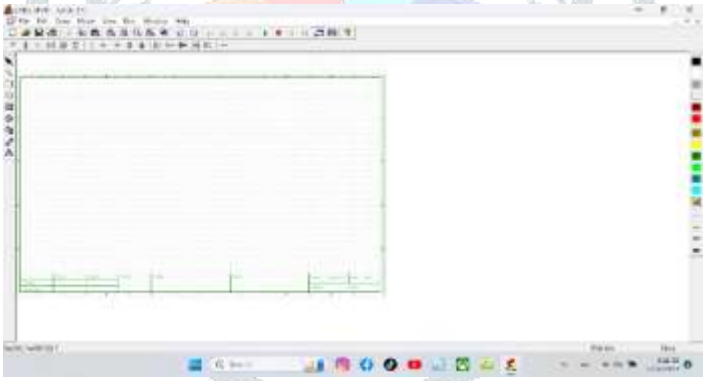


Fig. 6. Industrial circuit simulation software

CADe-SIMU software is specialized software for drawing electrical circuits in industry and can also simulate. CADe-SIMU fully supports symbols of specialized industrial devices such as Contactor, Circuit Breaker, Role, Input Source, Motor[6].

d) Simulate MAN Mode and Wifi Mode

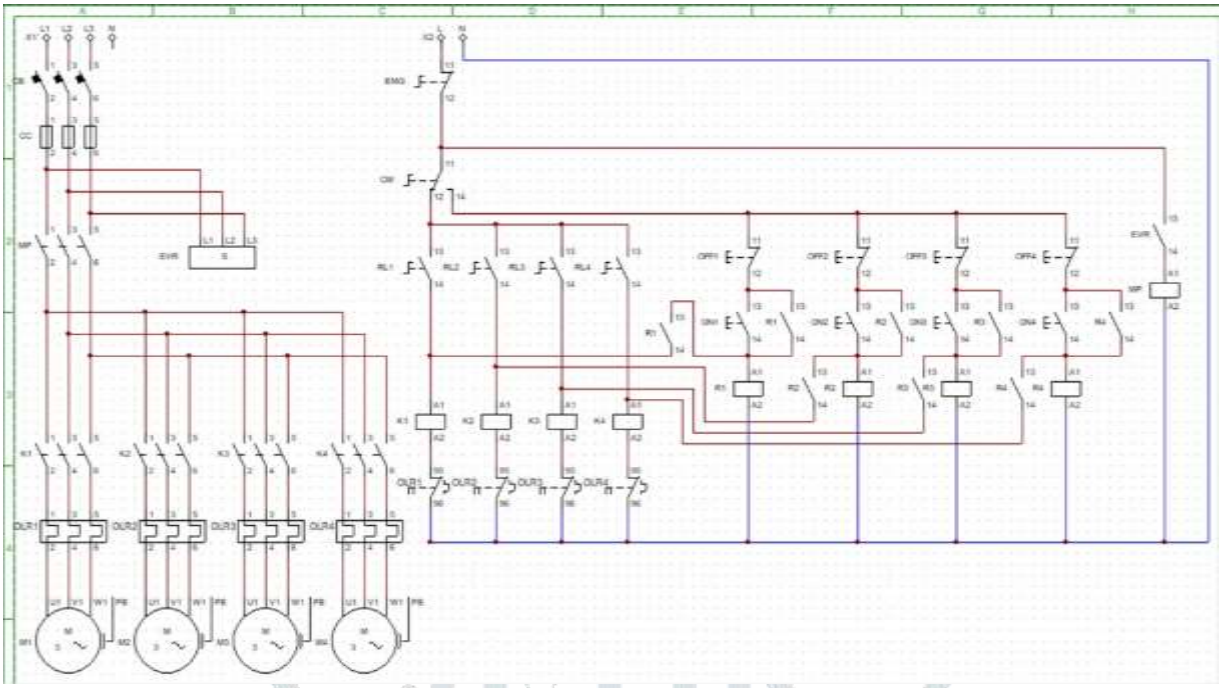


Fig. 7. MAN mode and Wifi mode of the drawing model on CADe-SIMU software

Wifi device control mode

The control commands from the Blynk application will be sent to the ESP32 Module, which will analyze the commands and compare them with the program installed on the ESP. Using the software, you can control any pin on the ESP32 Module without having to determine which command comes first or last. When the command received meets the conditions, the ESP will respond to the corresponding output command to the control unit and turn on the devices according to the user's control and monitoring. If the command does not meet the conditions, the device will be turned off.

MAN device control mode

Using the remote control mode of devices on the phone is very convenient because we can control and monitor the status of the devices. But when we encounter problems with the network connection or the remote control devices have problems, we switch to the push button control mode.

In this mode, we use the push button to control, when we press the push button, it will affect the control circuit and will compare the received signals and the received command meets the conditions, the device will turn on if the device is in the on state, it will return to the off state.

e) Wifi Module Connection Diagram

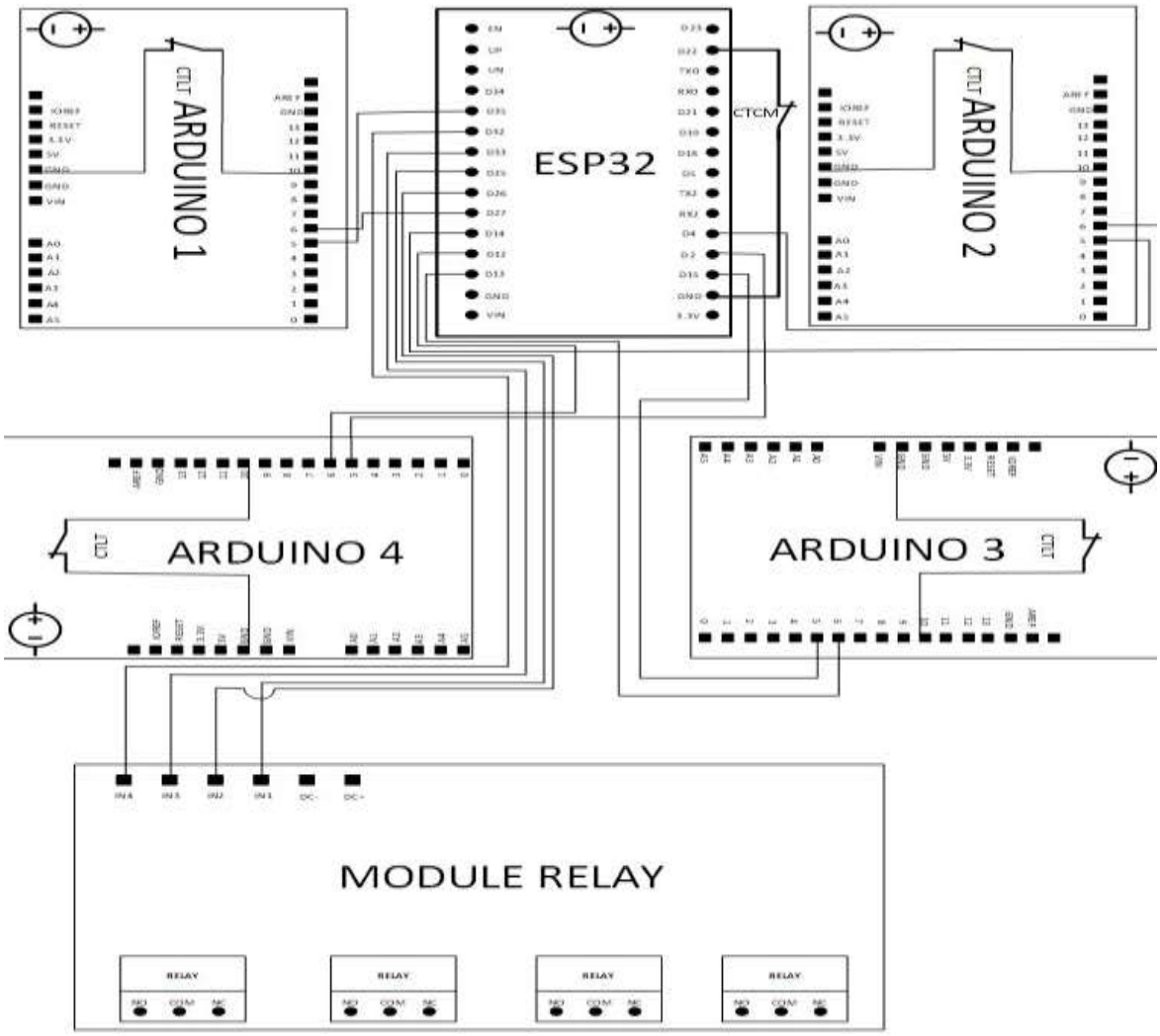


Fig. 8. Wifi Module Connection Diagram

Fig. 8. Pin connection board of Wifi Module

ESP 32	Module Relay	Arduino 1	Arduino 2	Arduino 3	Arduino 4
GPIO25	IN 1				
GPIO26	IN 2				
GPIO33	IN 3				
GPIO32	IN 4				
GPIO27		6			
GPIO35		5			
GPIO14			6		
GPIO4			5		
GPIO13				6	
GPIO2				5	
GPIO12					6
GPIO15					5

III. REALISTIC MODEL

After the implementation and research process, the group of authors has implemented the following model of motor monitoring and control system in shrimp ponds.



Fig. 9. Overall model



Fig. 10. Inside the control cabinet

IV. CONCLUSION AND FUTURE WORK

After a period of research and implementation, the group has completed a practical model that runs quite stably and meets the requirements. Completing the practical model as required helps us have a more realistic view. The model of the motor monitoring control system in the shrimp pond has been completed, knowing how to design and install the electrical cabinet for the model.

There is a system to monitor the status of the motor when there is a problem that causes the motor to stop working. Using a smart phone that can connect to the internet to access the application to monitor and control, and has performed the device control operation. To make the topic more complete, our group proposes the following development directions: The monitoring system can detect more errors on the engine. Control the rotation speed of the oxygen aeration engine according to each stage of shrimp development.

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