

## Design of Spinning Resistance Control System Based on MCU

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**Abstract**—Aiming at the problem of resistance control of spinning bicycle in the process of riding, in order to improve the resistance control of spinning bicycle to be more intelligent, a research on controlling the resistance of spinning bicycle by controlling the Angle change of steering engine based on single chip PWM signal is proposed. The method of simulating control resistance of steering gear is adopted to realize the control design of resistance of spinning bicycle. The design results show that controlling the resistance change of spinning with steering gear can meet the needs of users, provide users with more intelligent physical examination, and improve the fitness enthusiasm. Through simulation, the design results are basically consistent with the design theory, which proves the rationality of the steering gear in the design of the resistance control system of spinning bicycle.

**Keywords**-Spinning; MCU; Hall Speed; Steering Engine

### I. THE INTRODUCTION

With the development of society, the design of spinning arouses people's interest in sports. It can not only exercise the body, but also feedback the user's motion parameters to the user. On the market, there are a wide variety of spinning, function, quality, price and so on is the focus of the general attention of consumers, spinning control system involved in the main functions of the more comprehensive its price is more expensive, so designed a low-cost, multifunctional spinning resistance control system to better meet the needs of the people. To the research and development of spinning technology and innovation ability in China, such as blue fort D501 spinning series, the product features are: using rubidium boron magnet magnetic control type high strength resistance system, non-contact magnetic control resistance

free maintenance system to ensure that the system parts, completely improve the old system of wear and friction type noise problem, more comfort, let users ride in this design USES the servo simulation control spinning resistance size, not only solved the above problems, and intelligent design more convenient, can be resistance to control the size of the display to the user, the user according to the requirements of

fitness gear set different resistance, convenient for the user experience. And foreign research situation represented by the force of health in the United States, its Life cycle GX representative products, and its biomechanical design, through the user testing, data display can display various kinds of sports, in this design, spinning control system also has the timing, speed, mileage, and calories, data display functions such as resistance, convenient further resistance control, through the research, finally realizes the spinning resistance control system design, satisfies the requirement of theory with practice.

### II. OVERALL DESIGN OF SPINNING CONTROL SYSTEM

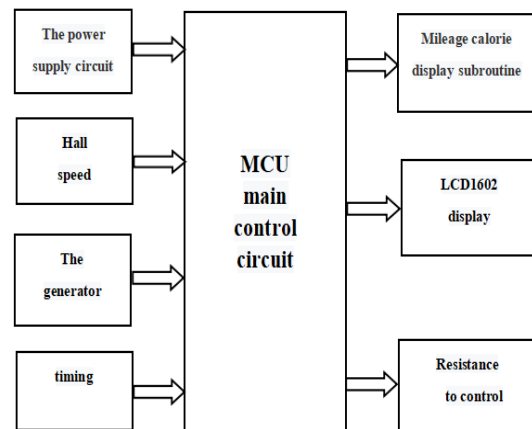


Figure 1. Control system block diagram

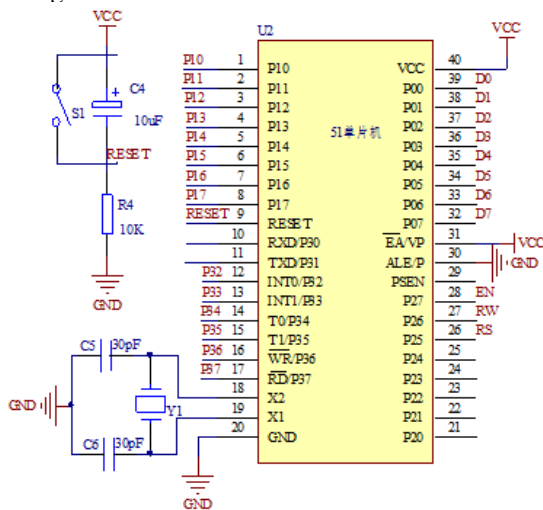
In the design of spinning control system, the master control circuit of single chip microcomputer is the core of spinning control system. It is responsible for the data and information response of each unit module, and controls the display screen and resistance control system. Hall speed measurement and mileage and calorie calculation information are integrated into the central controller. By driving the dc generator through the wheel of spinning bicycle, the bodybuilder converts the energy of cycling into

electric energy to supply the whole control system. However, due to the design of the physical object, the system is low voltage and cannot be moved, and the LED lamp is used to represent the power generation function. Through the steering PWM technology simulation spinning resistance size, through the key to achieve resistance increase and decrease, simulation resistance gear control. The speed measuring system transmits the wheel speed information to the user in real time to facilitate the user to adjust the resistance. At the same time, the display system can display the calories, mileage, timing, speed and resistance information consumed by the user, which is convenient for fitness users to use. The control system block diagram is shown in figure 1

### III. CONTROL SYSTEM HARDWARE DESIGN

#### A. Microcontroller minimum system design

The microcontroller minimum control system is the control core of the system and the master control system is one of the most important parts in the whole spinning design. It has the functions of system initialization, coordinating unit work and processing equipment data. In the hardware design, STC89C52 microcontroller is used, its internal timer count can obtain the timing function of spinning, using the microcontroller output PWM signal, the resistance control of spinning. Its versatility is strong, suitable for this project design and use. The microcontroller minimum system is shown in figure 2.



the microcontroller PWM signal control steering resistance control wiring diagram has three interfaces, grounding line 1, line 2 to the power cord, 4-5 v voltage of the steering gear, line 3 for the steering gear control line with STC89C52 singlechip P1.0 pin. Through single chip PWM signal adjustment duty cycle size, the realization of the steering gear Angle change control, to simulate the steering gear and spinning wheel clamping degree, the realization of resistance control. Finally, by the known resistance values, speed, range, can calculate the calories bodybuilders exercise value, coefficient of 0.02, caloric value of coefficient, mileage, the product of the resistance, then numerical display in the LCD display, resistance and calories for bodybuilders real-time understanding of sports consumption quantity of heat, spinning resistance control and calorie counting.

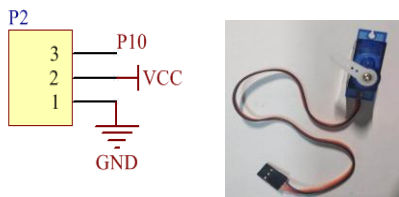


Figure 4. Resistance control wiring diagram of steering gear

#### IV. SYSTEM SOFTWARE DESIGN

##### A. Main program design

The main program design is the key to the operation of the entire spinning control system. In this design, the main program is responsible for calling and using all subroutines to ensure the normal operation of the system. It is an important part of the control system design. The system design features include timing, hall speed measurement, mileage and calorie counting, resistance control and LCD display. The main subroutines include timing subroutine, mileage and calories subroutine, hall speed detection subroutine, LCD display subroutine and resistance control subroutine. The flowchart design of the main program is shown in figure 5.

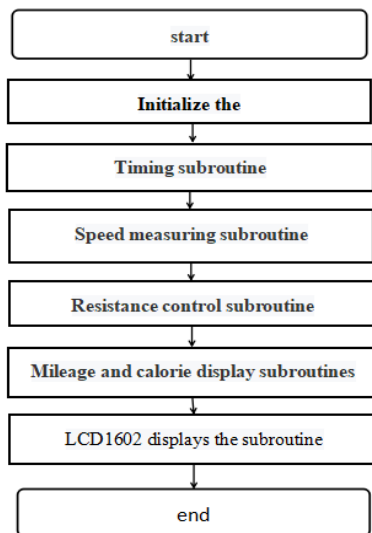


Figure 5. Main program flow chart

##### B. Speed measurement subroutine design

This design USES hall sensor module and magnet to complete the speed detection of spinning. When the magnet passes through the hall sensor with each rotation of the wheel and the signal is detected, the speed measurement subroutine is executed immediately. The design flow of speed measurement subroutine is shown in figure 6.

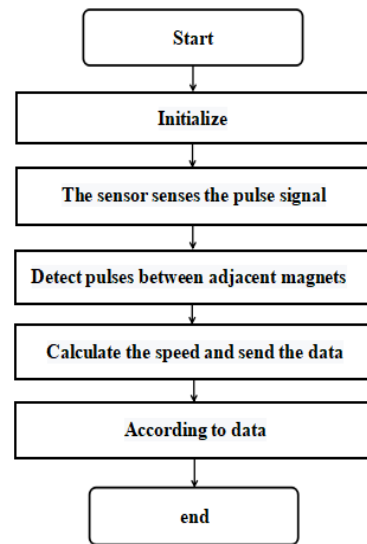


Figure 6. Flow chart of velocity measurement subroutine

#### V. CONCLUSION

By spinning resistance control system design, microcontroller PWM signal adjusting the duty ratio control steering Angle changes, to simulate the control of spinning resistance size, and designed a low cost, multi-function control system, spinning system solved the old friction wear and noise problems, allow the user to ride more comfortable and intelligent design more convenient, and the resistance to control the size of the display to the user, the user according to the requirements of fitness gear set different resistance, convenient for the user experience, reached the man-machine exchange effect. The design of the resistance control system of spinning greatly improves the passion of the bodybuilder and enricifies the effect of people's exercise, which is of great significance to the development of spinning in the future. In the future development, spinning will be combined with artificial intelligence, Internet technology, design a powerful, more and more popular with the public, the combination of sports and entertainment spinning control system, resistance regulation more intelligent and efficient, to give users a more comprehensive exercise effect.

#### ACKNOWLEDGMENT

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