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The Whole Scheme Design of the Multi-function Juvenile Automobile

HUANG Hao-jie , DOU Yan-tao , ZHOU Ting-ting , CAI Xiao-jun , LI Jian , KE Qiao-zhen

Mechanical Engineering College , Beijing Institute of Petrochemical Technology , Beijing 102617 , P. R. China

Abstract: In recent years , with the development of society , the juvenile automobile is also in increasing demand. But many of the juvenile automobiles in market are not perfect , and there are many security hidden troubles. According to this status , based on the Fischer technology a versatile juvenile automobile is designed , and many functions of automobile are simulated. And finally , the control procedure was successfully compiled and debugged. The automobile is versatile , for example obstacle avoidance , alarming automatically and long-distance control , which improves the whole security of juvenile automobile.

Key words: multifunction; juvenile automobile; whole scheme

1 Introduction

At present , our country is in the family planning stage and most children are from one child family , so how to insure the children's safety and healthy growth should be considered in every family^[1]. Juvenile automobile is an indispensable part of every child's life.

However the cars in the market are less than perfect in many ways at the moment. There are many unsafe factors which mainly reflect in the following aspects:

- 1) All juvenile automobile all have velocity mutation problems of both starting and stopping;
- 2) Juvenile automobile can not avoid obstacles automatically;
- 3) Juvenile automobile can't keep off danger automatically when it runs into a gill;
- 4) If the parents do not pay attention to their children , it is difficult to discover the children off timely;
- 5) It is hard for parents to control the distance between their children and themselves;
- 6) When children are driving their juvenile automobile , it is difficult for them to carry other toys;

bile , it is difficult for them to carry other toys;

7) As children grow up , the interior space of juvenile automobile reduces relatively , resulting in frequent renewal of automobile which leads to a waste of resources. In conclusion , we intend to design one juvenile automobile which can keep away from obstacles automatically and can be controlled by parents with automatic alarm. It will greatly increase the safety factor of juvenile automobile and ease parents. Combining with the Fischer technology , the design , assembly and control of the juvenile automobile was completed in this paper.

Fischer creativity combination model was developed in 1964 by German inventor Dr. Arthur Fischer based on the patented six splicing^[2-3].

The model includes mechanical components , electrical components , pneumatic components , sensors , computer controller and software components and so on^[4]. It uses mechanical transmission as the core , with sensor technology , computer technology , automatic control technology , robot technology as a whole. It is a kind of powerful tool which can exercise students' comprehensive design ability and wake up their team cooperation consciousness. It perfectly satisfies the requirements for training comprehensive design talents stipulated in the

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"excellence engineer education training plan" by the ministry of education requirements^[5]. The main aim in this paper is about the design of automobile's mechanical system and control system.

2 Design scheme of mechanical system

Multi-function juvenile automobile has basic function as the juvenile automobile which are in sale such as forward, backward and entertainment, it still has the following functions: automatic evades obstacles, automatic avoid ravine, start and stop buffer, control the distance with parents, automatic stop alarm and so on.

According to the above function, the mechanical system of multi-function juvenile automobile mainly consists of four major parts that is power travel agencies, start/stop buffer mechanism, direction control mechanism and folding case opening/closing mechanism (physical model as shown in Figure 1).



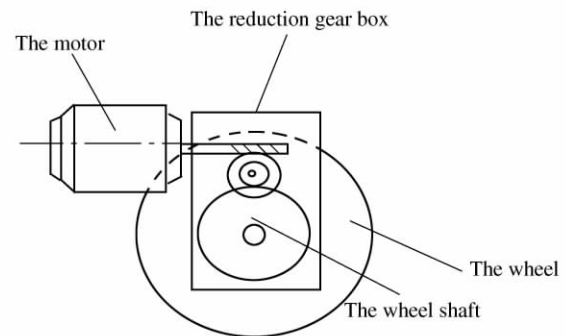
Figure 1 The overall picture of physical model

2.1 Dynamic locomotion mechanism

The conventional driving of the vehicle's normal moving is completed by two motors, using a multi-stage gear transmission to increase the torque. The transmission diagram is shown in Figure 2b). Two motors provide sufficient power for vehicles' moving to ensure the moving speed, and can achieve the purpose of steering by the coordinate of two electric motors.



a) The photograph of the actual mechanism



b) Transmission diagram

Figure 2 Diagram of walking power mechanism

The M_1 and M_2 electric motors provide power for the mechanism. The gear which directly connects with the motor. The number of the teeth is $Z = 10$. The driving gear on the wheel's spindle. The number of the teeth is $Z = 20$, then the angular speed of the wheel rotation is equal to half of the motor speed, according to the formula: $P = F * V$ (Power = force * speed). The reduction of the speed can increase the driving force of wheels, making rescue car move more

stable and can climb steeper slope when the power of motor in a certain circumstances^[6].

2.2 Start and stop buffering mechanism

Generally, when the juvenile automobile directly starts, it may make children backward varying degrees at the moment of starting due to inertia, then it will bring harm to the children in virtually. Parents will doubt about the security issues. At the same time, when the juvenile automobile is stopped, it has speed mutation.

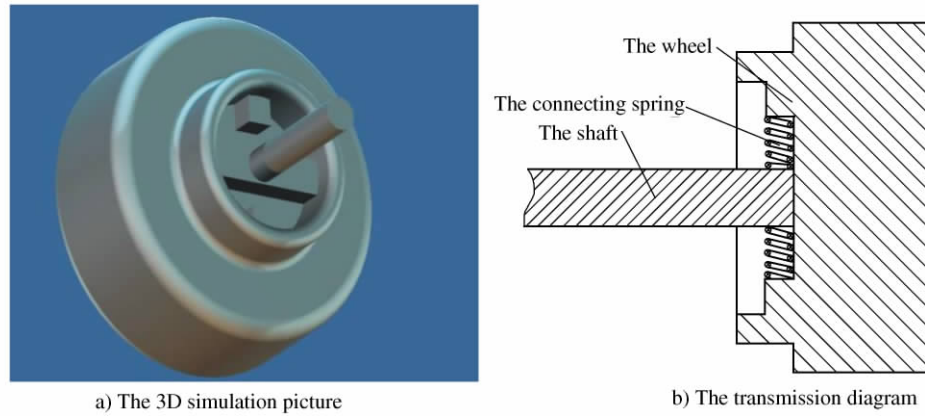


Figure 3 Start and stop buffering mechanism diagram

We added the start buffering equipment to the juvenile automobile. The 3D simulation image was shown in Figure 3. When the juvenile automobile starts, we can add a spring buffering device to eliminate the mutation phenomenon of the speed. When juvenile automobile stops, we can add the spring buffer device to eliminate the mutation phenomenon of the speed, which can make the children more comfortable in the use of the juvenile automobile. Using comfortably can ensure the children's enthusiasm for the juvenile au-

tomobile last longer, and fully guarantee the personal safety of the children^[7-8].

2.3 The mechanism of direction control

Multi-function juvenile automobile can realize two parts that is manual control of direction and automatic control of direction, manual control direction mainly through direction control mechanism to realize as shown in Figure 4 shows, automatic control of direction mainly through the different of two rear wheel speed to realize^[9-10].

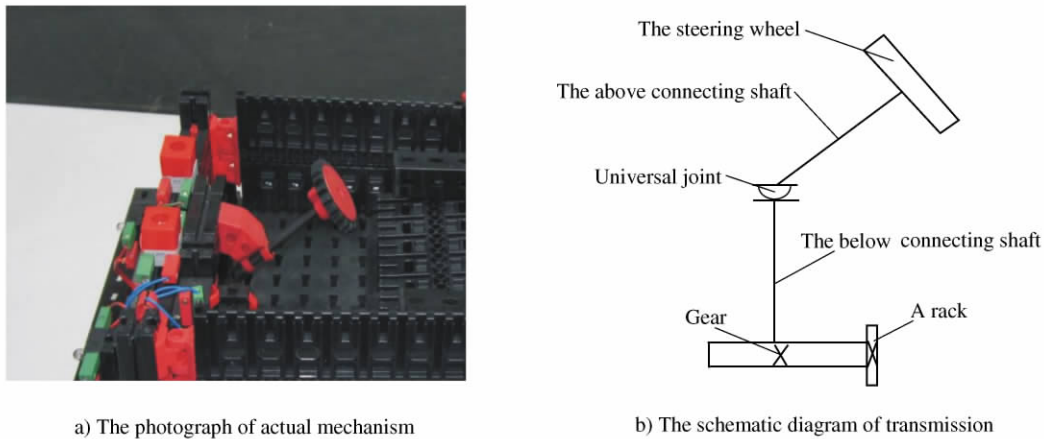


Figure 4 The schematic diagram of steering control mechanism

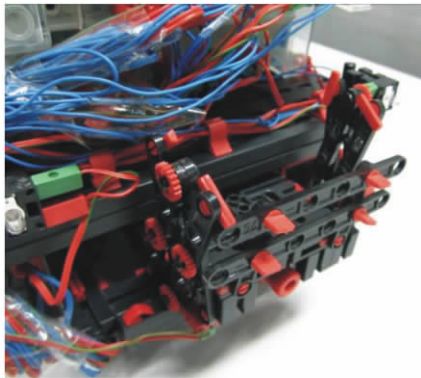
2.4 The opening and closing mechanism of folding carton

Folding container's opening and closing mechanism as shown in Figure 5 is consisted of the leading screw sliding block and the folding boxes. Folding boxes

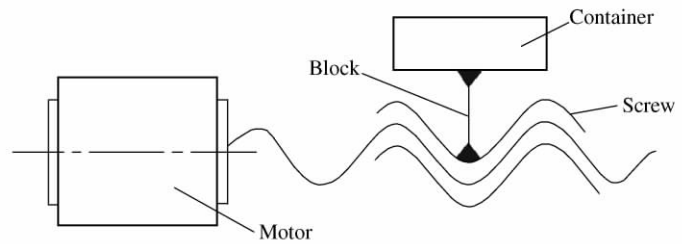
and block on the screw are fixed connection. The screw stretches the folding boxes out, in order to realize the purpose of storing goods. If you do not use the case, through the screw drive you can make the container fold, to reduce the space which the container

takes up. The mechanism makes the folding cartons pulled back and forth through the power of the motor

which can be reversible.



a)



b)

Figure 5 Schematic diagrams of folding container opening and closing mechanism

3 The design of control system

3.1 The overall control of scheme

For the purpose of entertainment, convenience and safety, the juvenile automobile has the security measures that can avoid the obstacle and ditch, and has the remote control function combined entertainment features on the current market. Only by this way can the juvenile automobile ensure the entertainment fea-

tures functions and further ensure the safety of the children. The juvenile automobile is unified controlled by the control program of intelligent control panel. The basic control program is shown in Figure 6. The procedure is also relatively simple. Every kind of sensor is actually binary switch, by using the switch's division to determine the state of the body to give the corresponding action command.

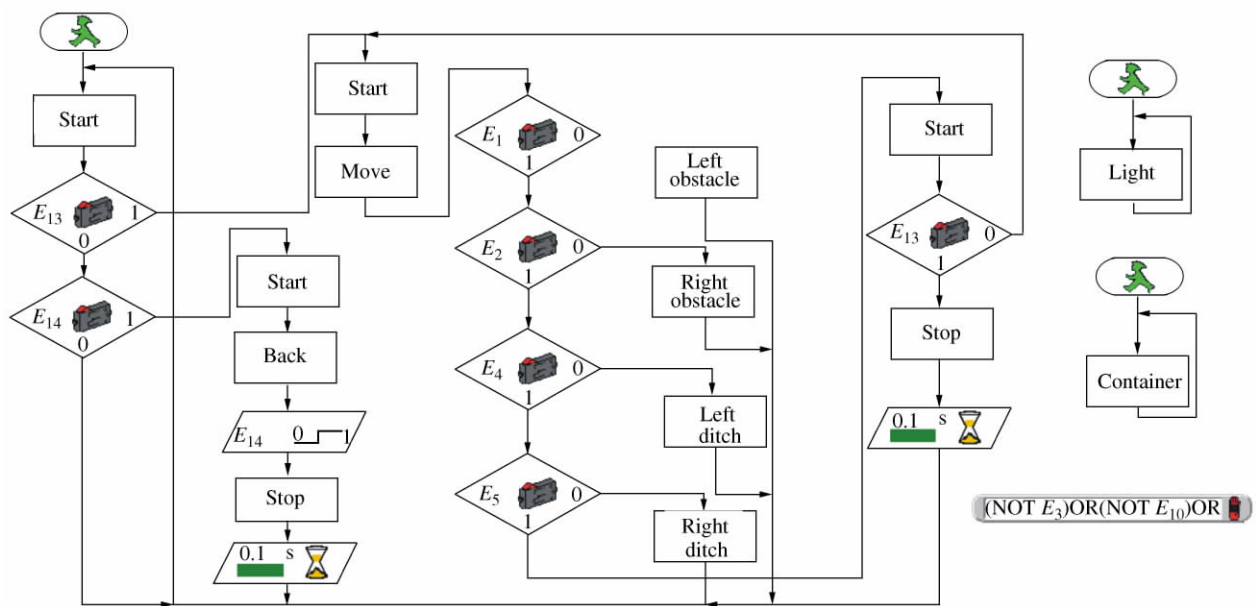


Figure 6 Basic control program

3.2 Each institution control scheme

Every action of the juvenile automobile is auto-con-

trolled by program , every device's name and its corresponding function is shown in Table 1.

Table 1 The component name and the corresponding function

Device	Realization function	Device	Realization function
M_1	Drive right round	E_7	M_2 count switch
M_2	Drive left round	E_8	Control limit switch in the fold packing box
M_3	Fold packing box	E_9	Control limit switch out of the fold packing box
M_4	Headlight	E_{10}	Right door switch
M_5	Taillight	E_{11}	Left door switch
M_6	Colorful lights	E_{12}	Fold packing box switch
E_1	Obstacle avoidance left trip switch	E_{13}	Move switch
E_2	Obstacle avoidance right trip switch	E_{14}	Back off switch
E_3	Press down the seat and start the car	E_{15}	Colorful lights switch
E_4	Avoid ditch switch on the left	E_{16}	Turn left switch
E_5	Avoid ditch switch on the right	E_{17}	Turn right switch
E_6	M_1 count switch		

1) Introduction of obstacle avoidance program: in the first place , move the program , M_1 and M_2 rotate positively , and the juvenile automobile moves on. When E_1 and E_2 are opened , the juvenile automobile keeps move on. When one switch among E_1 and E_2 is turned on , M_1 and M_2 have a reversal in the rotation and the juvenile automobile retreats a certain distance. When E_1 is turned on , M_2 will rotate positively and the juvenile automobile turns right to change its direction then to realize the function of avoiding obstacle. When E_2 is turned on , M_1 will rotate positively and the juvenile automobile turns left to change its direction then to realize the function of avoiding obstacle.

2) Introduction of the program of avoiding ditch: first , move the program , M_1 and M_2 rotate positively , and the juvenile automobile moves on. When E_4 and

E_5 turn off , the juvenile automobile will move on. When it meets the ditch , E_4 and E_5 turn on and the program is started automatically. Then M_1 and M_2 have a reversal in the rotation and the juvenile automobile retreats a certain distance. When E_4 is turned on , M_2 rotate positively and the juvenile automobile turns right to change its direction then to realize the function of avoiding ditch. When E_5 is turned on , M_1 rotate positively and the juvenile automobile turns left to change its direction then to realize the function of avoiding ditch.

3) Introduction of program to ensure start-up: The first , turn on the switch of E_{10} , E_{11} that on the car's door and the switch of E_3 , then turn on forward switch E_{13} and the juvenile automobile starts , M_1 and M_2 rotate positively , while the juvenile automobile moves

on , if any of the switch turns off , M_1 and M_2 will stop turning and warn so as to remind parents get there in time.

4) Introduction of program to control the children and parents' distance: First , Parents set scope radius length between children and parents with the remote control , then close the door of the juvenile automobile at the same time the switch of the door E_{10} and E_{11} turn on. The child sits in the saddle at the same time E_3 turns on to let juvenile automobile move forward. While the distance between the juvenile automobile and parent beyond the distance which the parent set before , the automatic program will starts up , M_1 and M_2 will stop rotating. Then specific program runs to let the juvenile automobile turn 180 degrees so that the child can play in the security range , at the same time the alarm will ring to warning the parent.

5) Introduction of program to folding container: When parent wants to use the folding container , parent can turn on switch E_{12} to let M_3 rotate , then the folding container will be stretched out until E_9 turns on , and then M_3 stops rotating. When parents don't need the container , parent can turn on switch E_{12} to let M_3 rotate , then the juvenile automobile will take the folding container back until E_8 turn on , and M_3 stops rotating ^[11-13] .

4 Conclusions

In today's world , the child's safety is parents' best wish , but children's car in the present market still exist many security problems. This design of the Multi-function juvenile automobile fully takes into account of children safety issues , and can ensure the safety through the simple control , so that it can improve the safety comprehensively.

This design not only achieves their goals of ensuring

the child's safe , but also can make children parents don't have to pay close attention to the children who are driving the juvenile automobiles. With the control of distance , safety alarm and a series of safeguards , to a certain extent , parents can let the children to play by themselves. At the same time , they can do some simple chores or some other things.

This design completes the ideal solution of increasing children's car safety device , and achieves the purpose to sets entertainment , security in one's purpose through the combination of a variety of functions , which makes children and parents at ease. Of course , this tentative plan is the combination of the fisch-ertechnik model , which may have a certain gap between the practical application , but the design of the model and the concept have a significant guidance to the juvenile automobile.

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Brief Biographies

HUANG Hao-jie is now an undergraduate candidate in the College of Mechanical Engineering , Beijing Institute of Petrochemical Technology. His research interests include Mechanical Design manufacture and Automation. shihuahuanghaojie@163.com

DOU Yan-tao is now a Ph. D candidate in the College of mechanical Engineering , Beijing Institute of Technology. His research interests include Application of Diagnosis Methods for Faults of CNC Machine Tools.

ZHOU Ting-ting is now an undergraduate candidate in the College of mechanical Engineering , Beijing Institute of Petrochemical Technology. His research interests include Mechanical Design manufacture and Automation.

CAI Xiao-jun is now a professor in the College of Mechanical Engineering , Beijing Institute of Petrochemical Technology. Her research interests include Mechanical Design manufacture and Automation.

LI Jian is now an undergraduate candidate in the College of mechanical Engineering , Beijing Institute of Petrochemical Technology. His research interests include Mechanical Design manufacture and Automation.

KE Qiao-zhen is now an undergraduate candidate in the College of mechanical Engineering , Beijing Institute of Petrochemical Technology. Her research interests include Mechanical Design manufacture and Automation.