THE PROJECT OF MICROCONTROLLER SUPPERTED SUMO ROBOTS

ÇETİNKAYA. Ö[1], KUŞÇU. H[2]

[1]Trakya University, Science Institute, Mechanical Engineering Department MBS Student, Turkey, ozcan@cetinkaya.gen.tr

[2]Trakya University, Engineering and Architecture Faculty, Mechanical Engineering Department, Turkey, hilmi@trakya.edu.tr

Abstract

Nowadays game and entertainment machines can not be limited by the improvement of microcontroller wich is used and programmed by simple programmers, by designing and improving various sensors and converters with producing in low costs. It is suggestable for humanbeings with getting beneficial applications in spite of it is an entertainment action. For example, it can be beginning work for a lot of systems as trackless trains and trolleys, a car that can regulate its curve cycle speeds according to the angle of road lines, to allow passing or overtoking automatically or not, regulating the vehicle pursit distance automatically, and unmannend parking systems.

Key Words: *Robot, Sumo, Microcontroller, GP2D02, CNY70*

INTRODUCTION

Sumo wrestling is a kind of traditional wresting in Japan is founded on many custums and morals since ancient times. Sumo means Sumafu in Japaneese which means defending ownself.

The aim of sumo wrestlers is to push his rival out of the arena, named dohyo which is a sand pool or a place enclosed with straw rope or to fall over him.

By the improvement of technology many game and entertainment machines are improved as a hobby or entertaintment. In this study the project of microcontroller supperted sumo robots are going to be deseribed.

While imagining our sumo robot, first of all dohyo(arena) in which our sumo robots wrestle propared duo to remain true to the laws of sumo wrestling in real life. Compared to the huge of our robot, dohyo is set from a coloured circle that has got a size in which two robot can move easily. Dohyo ‘s inside is black and it has got a white circle in 1-2 cm thickness around as in figure 1.

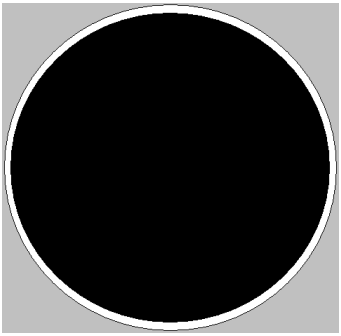

Figure - 1, A typical dohyo designed for sumo robots.

The white streamer around the circle if dohyo sets a limit to competition area.

CONSTITION

Our sumo robot is constituted from an electrical PIC16F84A microcontroller and two CNY70 black-white sensors, a numeral GP2D02 distance sensor which work as to the microcontroller and from a DC motor contains two gearcase which acquire the ability of movement to robot. It has got two active wheels which is stimulated by dc motor contains two gearcase wihch acquire the ability of movement and has got two passive roller wheels which acquire its balance. These passive roller wheels are not stimulated by a motor also they can change their directions according to direction of active wheels.

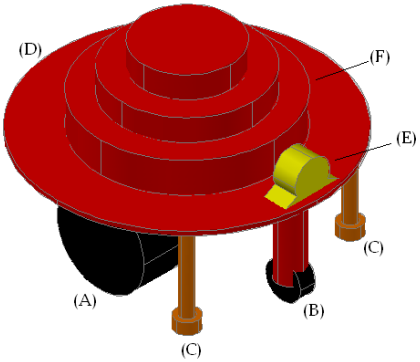

Figure - 2. Sumo robot, used in our work and its parts.

A- Active wheels controlled by DC motor.

B- Passive Roller wheels.

C- CNY70 Black-White sensor

D- Main body of sumo robot

E- GP2D02 Distance sensor

F- Section of presented electronic cycles

A basic somu robot is being seen in figure-2. Impulsion motors are mounted both side of the robot over the same axis. Rollers are mounted on the same platform that makes a 90° angle with the axis on which motors are baunded. CNY70 sensors must be mounted next to the ground as in the figure. One of these sensors must be mounted on the right side and the oyher is on the lest side of the robot but their eyes must see the white line that surrounds the dohyo. GP2D02 sensors are mounted in front of the robot as if it can see the rival and look ahead too.

Working :

GP2D02 distance sensor sends an infrared light beam that assings the distance between the object againts it according to the returning angle of the light beam that strike an object and turn back to receiver.

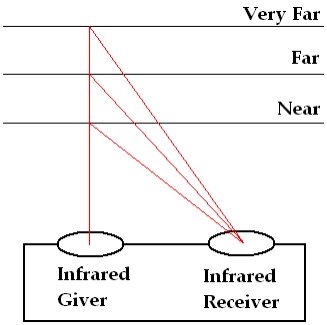

Figure-3A

Figure-3B

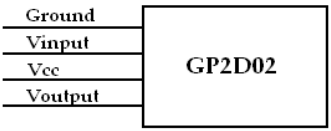

Figure-3C

Figure-3A, GP2D02 Basic working principle of distance sensor.

Figure-3B, GP2D02 Physical appearance of distance sensor.

Figure-3C, GP2D02 Leg joint of distance sensor.

Returning angle of this light beam corresponds to an eight bites signal (a numerical number between 0-255). This account is not linear with distance. But it is understood that distance among the object becomes shorter when the account gets bigger. The aim of using GP2D02 distance sensor in this work is to determine the action direction by enumerating the distance between its rival that stands opposite.

The function of CNY70 sensors is sending Logic-0 signal to the microcontroller which means that the robot is moving in dohyo or in black area. One of the CNY70 sensors sends Logic-1 signal to the microcontroller when the robot comes very close to the white line which surrounds dohyo. The signal means the robot is out of dohyo and then microcontroller sends a signal to the motors to move back. In other words, CNY70 sensor gives data for our sumo robot to the microcontroller about the movement direction in dohyo and the exact place in it.

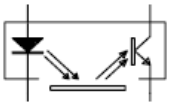

Figure-4A

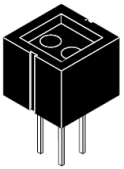

Figure-4B

Figure-4A, Internal structure of CNY70 sensor

Figure-4B, Physical appearence of CNY70 sensor

If the distance between robots, perceived by GP2D02, is shorter than the determined value(40-80 cm) it sends forward signal to both motors for forward movement of microcontroller robot. Whether the distance is shorter, robot looks for therival inside dohyo and when it gets closer to the rival, it moves forward and tries to push its rival out of dohyo. Motors of the sumo robots have to be strong as real sumo wretlers using servo motors which is used as a hobby and can make 120°-180° angle, is suitable to supply high movement at sumo robots. But we can not use these robots directly in our Works. By removing the control part of servo motors and the chip which makes angle restriction, we can obtain a redactor motor that can produce enough moment for roling microcontroller drives two motors which gives action to the robot with L293D motor driver integrated. This driver can give a free movement in both sides to the motor autonomously from eachother. This movement supplies high movement ability to sumo robot and it achieves to turn its own around. A software is needded for PIC16F84A microcontroller to control the actions of robots according to the rules of sumo wrestling. This software acquires not to go out of game area by the help of signal comes from GP2D02 which acquires our robot to find the location of the rival. The software which is used for this robot is developed with PICBASIC programming language, electronic circuit schema which is prepare with Proteus ISIS programme and software code which is written by PICBASIC is being seen below.

On the software; right motor forward and back movement signal has been nominated to 0. and 1. ports of B port of microcontroller, left motor forward and basic movement signal is nominated to 2. and 3. ports of B port of microcontroller.

At the right side of the sensors of CNY70 is nominated as forth of B port and on the left side of it is nominated as fifth of B port. Clock(Vout) terminal of GP2D02 distance sensor is nominated to the 6. port of B port, however DATA(Vin) terminal is nominated to 7. port of B port.

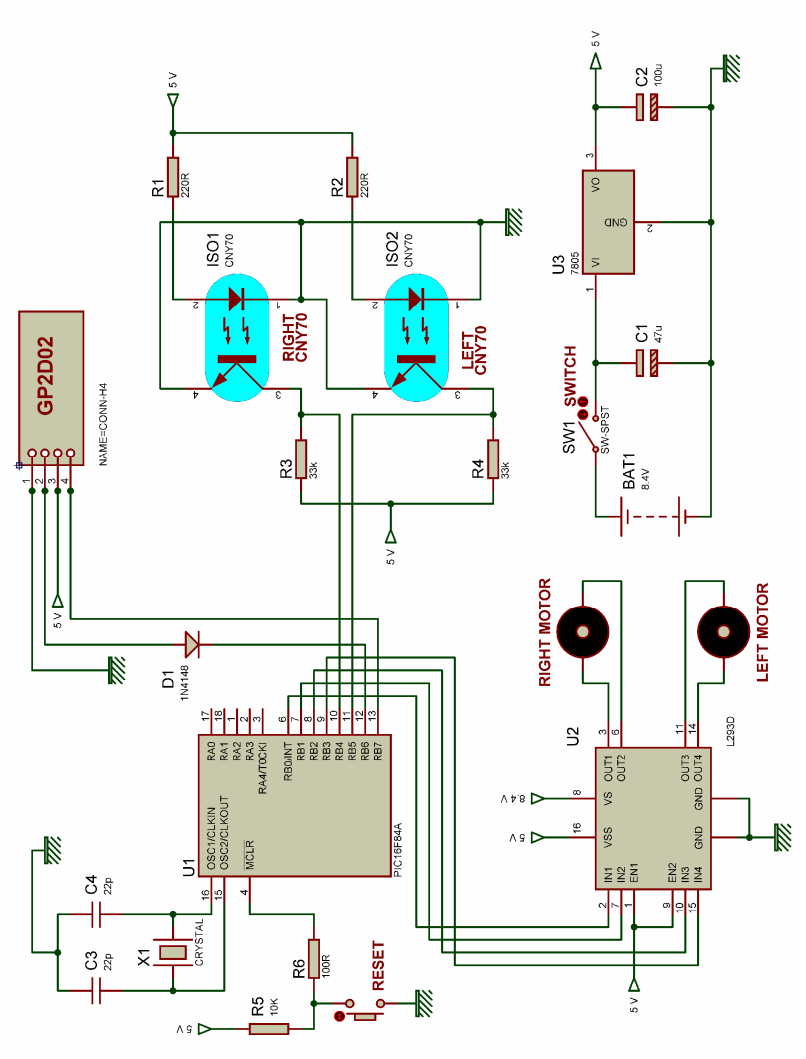

Figure-5, Electronic circuit schema of Sumo Robot

Microcontroller code wich is prepored by PICBASIC

```
INCLUDE “sumorobot.bas”

; === ACTION OF MOTOR IS DETERMINED ===
SYMBOL RIGHT_NEXT       = PORTB.0
SYMBOL RIGHT_BACK       = PORTB.1
SYMBOL LEFT_ BACK       = PORTB.2
SYMBOL LEFT_ NEXT       = PORTB.3
```

```
; === CNY 70 AND GP2D02 ARE DETERMINED ===
SYMBOL CNY_RIGHT        = PORTB.4
SYMBOL CNY_LEFT         = PORTB.5

CLOCK   VAR     PORTB.6
DATA    VAR     PORTB.7

;       INPUT/OUTPUT PORT ARE DETERMINED OF PORT B
TRISB   =       %10110000

VALUE_GP2D02    CON     80

LENGHT_1        VAR     BYTE
LENGHT_2        VAR     BYTE
BACK_RTRN       VAR     BYTE
CONTROL         VAR     BYTE
GOAL            VAR     BYTE
UNIT            VAR     BYTE
NN              VAR     BYTE

; MAIN PROGRAM

GOSUB STOP
PAUSE 3000

GOSUB CLOCK_WISE
PAUSE 10

MAIN:

GOSUB   READ
GOSUB           EVULATION
GOTO            MAIN

EVULATION:

IF LENGHT_1 >=VALUE_GP2D02 THEN

CALL FORWAD
PAUSE 1

ENDIF

RETURN

FORWAD:
HIGH    RIGHT_NEXT
HIGH    LEFT_NEXT
LOW     RIGHT_BACK
LOW     LEFT_BACK
RETURN

CLOCK_WISE:
HIGH    RIGHT_BACK
HIGH    LEFT_NEXT
LOW     RIGHT_NEXT
LOW     LEFT_BACK
RETURN

ANTI_CLOCK_WISE:
HIGH    RIGHT_NEXT
HIGH    LEFT_BACK
LOW     RIGHT_BACK
LOW     LEFT_NEXT
RETURN

BACK_GO:
LOW     RIGHT_NEXT
LOW     LEFT_NEXT
HIGH    RIGHT_BACK
HIGH    LEFT_BACK
RETURN

STOP:
LOW     RIGHT_NEXT
LOW     LEFT_NEXT
LOW     RIGHT_BACK
LOW     LEFT_BACK
RETURN

READ:
LOW CLOCK
WHILE DATA=0
WEND
PAUSE 5
RETURN
```

CONCLUSION

A general information about improving a sumo robot and working principles of sensors on the robot is defined in this study which has a preliminary work ability for the robots that are going to be improred as hobby robots. By redoubling the number of sensors used in sumo robot, a high capacity of movement ability can be produced as a sumo wrestler. This study can form a source for the applications that administer for humanbeings even so it is for an entertainment. For example, it

canbe beginning work for a lot of systems as tracless trains and trolleys, a car that can regulate its curve cycle speeds according to the angle of roadlines, to allow passing or overtalking automatically or not, regulating the vehicle pursuit distance automatically, unmanned parking systems and etc.

REFERENCE

1. http://users.encs.concordia.ca/~dave/project/project.html
2. http://www.robotroom.com/SumoRules.html
3. http://www.tcrobots.org/articles/a03.htm
4. http://www.datasheetcatalog.org/datasheet/vishay/83751.pdf
5. http://www.datasheetcatalog.org/datasheet/vishay/83