MULTIPLE TASKS PERFORMING ROBOT BY USING FIREBIRD V

[1]Prof. Nilakhe O.C., [2]Mane Aparna V., [3]Kshirsagar Bhagyashri S., [4]Todkar Prajakta R., [5]Mujawar Tabassum U.

[1]Assistant Professor, [2,3,4,5]Students
Department of Computer Science & Engineering
Dnyanashree Institute Of Engineering And Technology,satara.

***Abstract*: Robotic technology has the origin from the year 1954 and has very vast application in the field like energy, health, agriculture, education, research, motion and space etc. Here we are using the Fire Bird V robotic technology as our robotic medium, which has the Atmega2560 as its microcontroller and where it uses Studio 5.1 as its controller's software platform. The control dynamic to the robot is sent via the software platform which is embedded C language. In this project robot is performing following tasks:**

1. **White Line Following Robot.**
2. **Cleaning.**
3. **Obstacle Avoidance.**
4. **Pick and Place Object.**
5. **Draw Rangoli.**

***Index Terms*: IR Sensor, Proximity Sensor, Position Encoder, White Line Sensor, Photo Transistor, Buzzer, LED, Fire Bird V, AVR studio.**

I. INTRODUCTION

Robot is derived from an Old Church Slavonic word "robota" which means "forced labor"[3]. So robots were designed to help the human in order to reduce our work pressure. Here we use a Fire Bird V robot which is a microcontroller based robot used for any kind of robotic application. This was designed by IIT Bombay along with MHRD. It has the name Fire Bird V robot because it is the 5th in it series. It uses 2 Atmega controller where it acts as a master control is the Atmega 2560 and a slave control is the Atmega 8.

The basic block diagram of Atmega 2560 based robot is shown above. The various components involved in designing of the white line follower.

Robot consist of the following component:

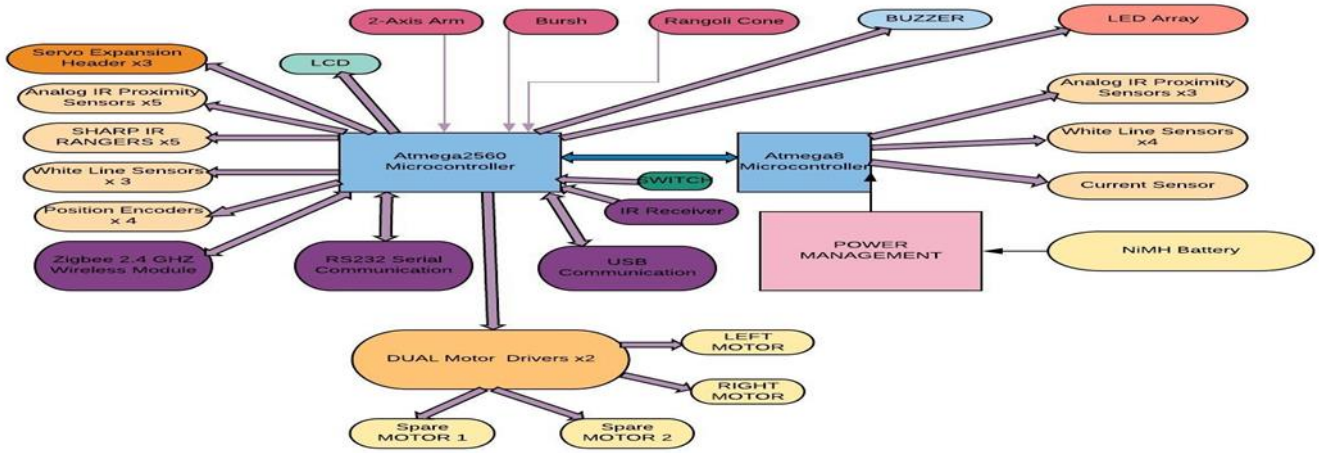

Fig- Block diagram of Fire Bird V.

1. Power management
2. Sensing
3. Actuation (locomotion)
4. Communication
5. Intelligence (microcontroller)
6. Other peripherals

A. Power Management:

Fire Bird v robot uses a nickel metal hydride (Ni-MH) battery with a 9.6V rechargeable pack. The battery voltage can vary between 12V (fully charged) and 8V (discharged) condition[1].

B. Sensors:

Sensor is an object which is used to sense an event or changes in the area. Sensors are basically a transducer and they give the output in electrical or optical terms [1].

Sensors used in this project:-

- Three white line sensor.
- Five sharp IR range sensor.
- Eight analog IR proximity sensor.
- The position encoder sensor.
- Current sensing sensor.
- Battery voltage sensor.
- Five Ultrasonic sensor.

C. Actuators:

Actuator is a type of motor that is responsible for controlling a mechanism. Here the actuators are used for moving the robot. The following are being used in it. This includes [1]:

Two 60rpm geared motor
Servo motor

D. Communication:

Communication between the robot and the system can be done through two modes. Here the robot could talk or communicate with other robot or PC. They are [1]:

Wired communication
Wireless communication

In wired communication the data transfer takes place with the help of cables. The commonly used cables are USB, RS-232 cables and USB to serial communication cables etc.

F. Other Peripherals:

The other peripherals consist of the indicating or displaying devices. These displays are used to indicate the final value or indicate if any error is present by displaying or by giving sound. The devices used for indicating are 16 x 2 alpha numeric LCD , LED,Buzzer[1].

II.REVIEW OF LITERATURE

Is a Firebird V ATMEGA2560 ROBOTIC REASRCH PLATFORM Hardware Manual," Fire Bird V ATMEGA 2560 Hardware Manual, IIT Material science by Bombay". This manual is refers for understanding the basic components of firebird v[1].

Is a Firebird V ATMEGA2560 ROBOTIC REASRCH PLATFORM Software Manual," Fire Bird V ATMEGA 2560 Software Manual, IIT Material science by Bombay". This manual is refers for understanding the how to install and use software's of firebird v[2].

M. S. Islam & M. A. Rahman, "Design and Fabrication of Line Follower Robot" Asian Journal of Applied Science and Engg, Volume 2, No 2 (2013) ISSN 2305915X .In this paper White line sensors are being used for tracking the white line on the surface. LED which is used for illuminate the path on white line and photo transistor used for sensing the line[3].

Bharat Jain, Dinesh Rajpoot , "Pick n Place Robot". In this paper pick and place prototype, the object is picked color wise and color of object is identified by using MATLAB Technology and image processing is used to pick the object on nearest distance by using robotics arm[4].

RM.Nachammai,G.Lavanya,N. Mrujool Kansara,R.Gopalakrishnan," Obstacle Detection and Path Crossover using Fire Bird V Robot". In this paper our robot detects the obstacle which is on the cross line path, avoids the obstacle and move forward until the obstacle is not detect [5].

III.PROPOSED SYSTEM-

The proposed system is designed to a robot which perform multiple tasks:

1) White Line Following Robot:

The first objective of this prototype is the robot move on the white line surface as in the program. Here as the name indicates that is white line following robot, it detects white line by using 3 white line sensors which are modulated at the bottom of the robot. This white line sensor has two pairs i.e. emitter and receiver. Emitter is LED and Receiver is photodiode.

By using the sensors robot detects the path based on color i.e. white or black. When the robot is on white line then more amount of light gets illuminated in the path, when the less amount of light gets illuminated the robot on the dark surface.

Algorithm:

1. Start
2. Read the sensor values.
3. If the ground surface is white.
4. Then follow the white line until its end.
5. Stop

Flowchart:

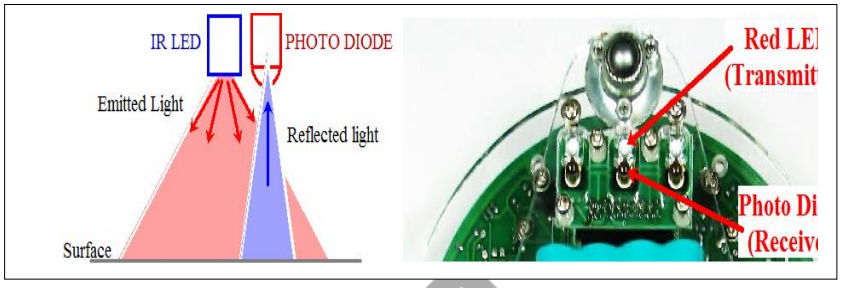

Fig-white Line Sensors [1]

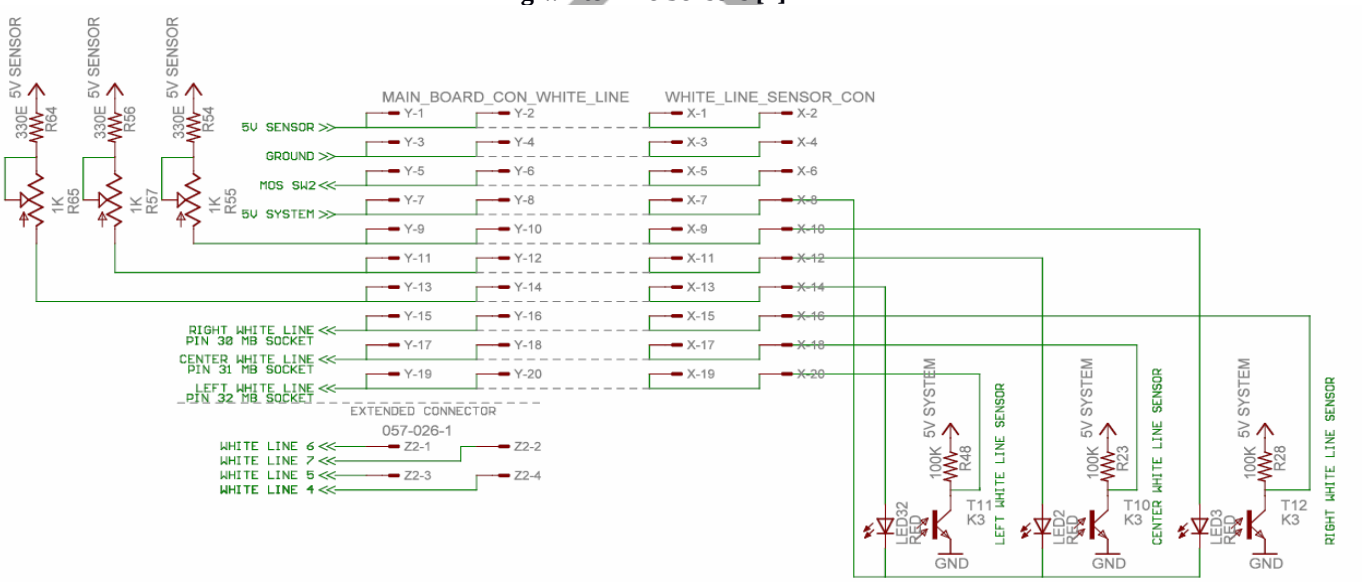

Fig : Schematic of the white line sensor[1]

2) Cleaning:

The second objective of this prototype is to perform cleaning by using brush ,which is externally mount on the front of the robot as shown below . In that robot cleans the dust which is on the white line and moves forward until the white line is sensed.

Algorithm:

1. Start
2. Attach the cleaning brush at the front of the robot.
3. If the brush is fitted properly.
4. Then it clean the surface.
5. Stop

Flowchart:

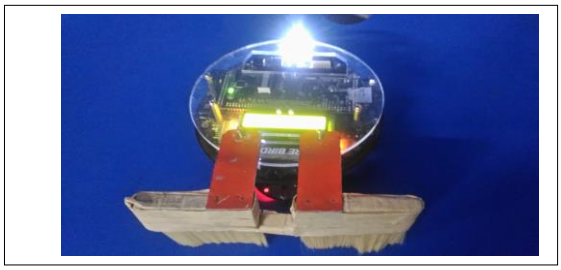

Fig-Cleaning Module.

3) Obstacle Avoidance:

Here as the name indicates the sharp IR range sensors are being used for sensing the obstacle on the surface. They are used for accurate distance measurement. The sharp IR range sensor come in the two pairs, i.e. IR LED and linear CCD array. Robot learns with the help of IR LED and then transmits a narrow IR beam. Light reflects back from the obstacle, depending on the distance from the obstacle. Angle of the reflected light varies. This angle is measured using the CCD array to estimates distance from obstacle. Sensor measurement is based on triangulation and not on intensity of the reflected light. In this prototype, robot actually detects the object as an obstacle and avoid obstacle by moving the right side and move forward.

Algorithm:

1. Start
2. Robot goes forward and read the sharp IR range sensor values .
3. If obstacle is detected .
4. Then robot avoid the obstacle,turn left and move forward.
5. Else robot move forward until object is not found.
6. Stop

Flowchart:

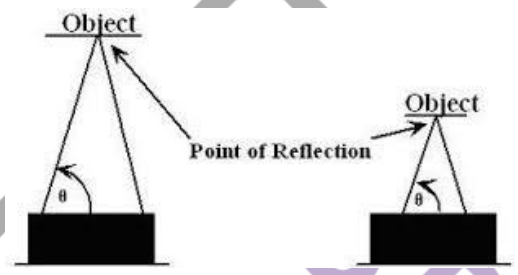

Fig- Obstacle Sharp IR Sensor [1]

4) Pick and place:

Another objective of this prototype is to pick any small, less weighted object and place it. In this prototyping externally arm assembler is mount, on robot front side of glass cover. This arm is provided by Nex-Robotics laboratory. We have used two axis arm and two servo motors for arm movement.

Algorithm:

1. Start
2. Robot detect the object.
3. If object is light in weight then robotic arm pick the object.
4. Else object is not light in weight then it goes forward.
5. According to step 3 place the object to the another side.
6. Stop

Flowchart:

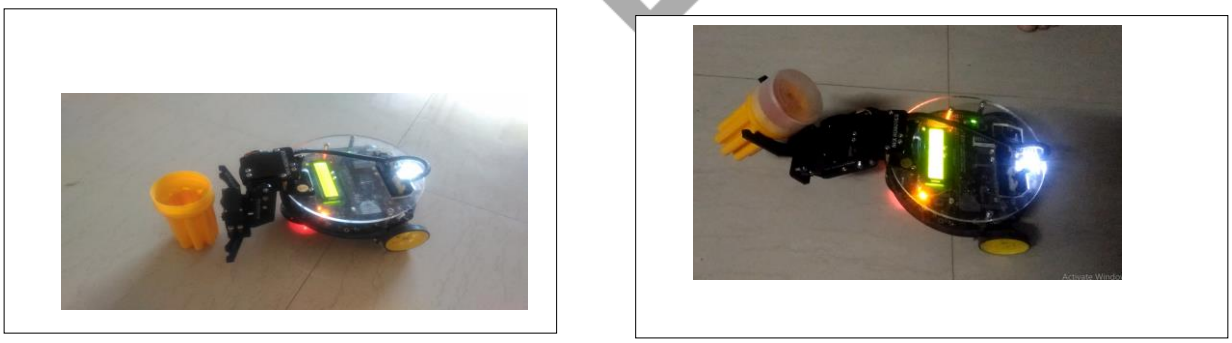

Fig- Pick and Place Module.

5) Rangoli:

Rangoli is very interesting task which is an art form. Rangoli play very important role in Indian traditional festivals because the purpose of rangoli is decoration. Rangoli design can be simple geometrical shapes , flowers and petal shapes. In rangoli task

robot are drawing simple geometrical shape on surface. Firstly we merge the pick and place task which is used for grip the rangoli cone and draw the Rangoli.

Algorithm:

1. Start
2. After attaching the robotic arm to the robot rangoli cone is fitted in the robotic arm.
3. If rangoli cone is fitted in correct way with its filled with rangoli.
4. Then robot draw the basic shapes of rangoli on the plain surface.
5. Stop

Flowchart:

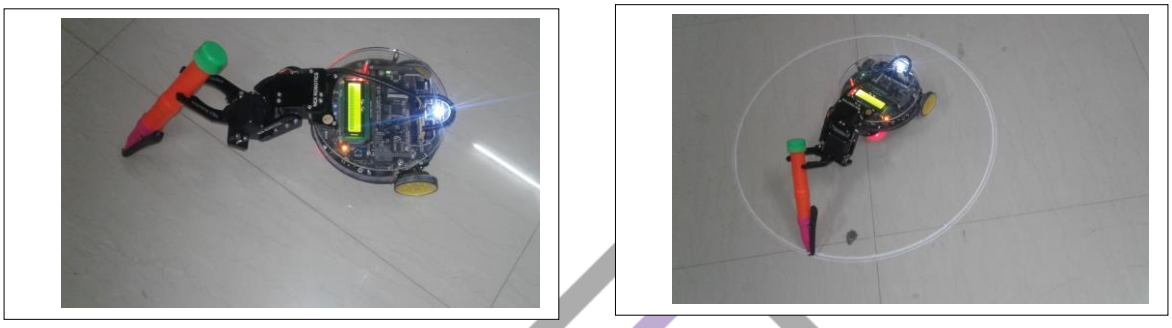

Fig:-Drawing Rangoli.

IV.MATHEMATICAL MODEL:

Wheel circumference: 5.1cm * 3.14 = 16.014cm = 160.14mm
Where,
Wheel diameter: 5.1cm
Number slots on the encoder disc: 30
Position encoder resolution: 163.2 mm / 30 = 5.44mm / pulse.

Distance in mm for GP2D12=(int)(10.00*(2799.6*1.00/(float)((double)(ADC_value)^(double)(1.1546)));
ADC value=Analog to digital converter
Mm=millimeter
Distance between Wheels = 15cm
Radius of Circle formed in 3600 rotation of Robot = Distance between Wheels / 2 = 7.5 cm
Distance Covered by Robot in 3600 Rotation = Circumference of Circle traced = 2 x 7.5 x 3.14 = 47.1 cm or 471mm
Number of wheel rotations of in 3600 rotation of robot = Circumference of Traced Circle / **Circumference of Wheel** = 471 / 160.14 = 2.941
Total pulses in 3600 Rotation of Robot = Number of slots on the encoder disc / Number of wheel **rotations of in 3600 rotation of robot** = 30 x 2.941 = 88.23 (approximately 88)
Position Encoder Resolution in Degrees = 360 / 88 = 4.090 degrees per count[1].

V. HARDWARE/SOFTWARE REQUIREMENTS

Hardware Requirement:

- Firebird V Robot .
- Robotic Arm.
- Cleaning Brush.
- Rangoli Cone.

Software Requirement:

- .NET Framework
- AVR Studio 5.1.
- Embedded C Program Coding.
- AVR Bootloader.

VI. CONCLUSION

Thus the maximum stability for the traverse condition through white line following technique is achieved. As the robot path condition is controlled by three white line sensors with maximum proximity, the path alignment is achieved .Here the robot completes the task assigned in both low speed and top speed condition, which is done with the help of perfect coding. Whenever the robot is deviated from its original track it gets resolved quickly by sensing the leakage current and it returns to its original path.
Thus the robot can be used in future for home automation, in shopping mall, in small scale industries for manufacturing plant.
Thus this prototype is used for performing multiple tasks.

VII. ACKNOWLEDGMENT

We take this opportunity to express our gratitude to "Dnyanshree Institute of Engineering And Technology Sajjangad, Satara." For sanctioning us the project **"**Multiple tasks performing robot by using FireBird V**"** And for allowing access to various facilities in this institute.
Firstly, We are deeply indebted to Nex-Robotics IIT Bombay , E-Yantra and it's lab for giving robot gadget for completing final year Project. We are extremely grateful to Hon.R.D.Wangde (MD. DIET Satara) and Hon.Dr.A.D.Jadhav(Principle DIET Satara) for extending all facilities to us for smooth progress of our project work. We wish to express our heartily thanks to our guide Prof.O.C. Nilakhe Assisant Proffesor of our college for guide us. We would also like to express our sincere respect to other teaching & non- teaching staffs.

REFERENCES

[1] Fire Bird V ATMEGA 2560 Hardware Manual, IIT Material science by Bombay.
[2] Fire Bird V ATMEGA 2560 Software Manual, IIT Material science by Bombay.
[3] M. S. Islam & M. A. Rahman, "Design and Fabrication of Line Follower Robot" Asian Journal of Applied Science and Engg, Volume 2, No 2 (2013) ISSN 2305915X
[4] Bharat Jain , Dinesh Rajpoot , "Pick n Place Robot".
[5] RM.Nachammai,G.Lavanya,N. Mrujool Kansara,R.Gopalakrishnan," Obstacle Detection and Path Crossover using Fire Bird V Robot".
[6] http://ieeexplore.ieee.org