International Journal of Engineering Research in Electrical and Electronic Engineering (IJEREEE) Vol 2, Issue 5, May 2016

Patient Monitoring Robot

[1] Amrutha. R, [2] Lalitha. K [3] Deepika T V,
[1][2][3] Asst Prof, Dept of EIE
GSSS Institute of Engineering & Technology for Women, Mysore

Abstract: **-- This paper describes the techniques for analyzing, designing, improving and controlling the health care management system. Autonomous Intelligent Robots can perform desired tasks in any type of environment without the continuous guidance of human. A line follower robot is automated device programmed to follow a specific path. A line following robot carries the medicine to the patient whenever they need it based on the predefined path that can be either visible on a black line on a white surface or vice-versa. An IR sensor remote is used by the nurse or technician, based on which the data is sent to the system or the robot. In this algorithm Firebird V microcontrollers are used to deliver the requested provisions by the patients in the hospital. It uses three levels of feedback for path alignment, rotation offset and for avoiding obstacles. Since the path of the wards remains same in the hospitals, so a fixed path is defined and is loaded to the Firebird V through codes. In this project the robot used is Firebird V ATMEGA 2560.**

Keywords:– **Line follower robot, Firebird V ATMEGA 2560 Microcontroller, Autonomous Intelligent Robots.**

I. INTRODUCTION

A Robot is or virtual artificial agent a electro-mechanical machine which is guided by a computer program and electronic circuitry. Robotics is a branch of technology which deals with the design, construction, operation, and application of robots along with these computer systems are used for their control, sensory feedback, and information processing. These robots can take the place of humans in dangerous environments or even in manufacturing processes. Autonomous robots are particularly desirable in fields like hospitals, household maintenance (such as cleaning) and delivering goods and services.

There are two main functions for robot in healthcare. One is to assist an individual such as patient and the other robots are those which help in overall systems such as pharmacies and hospitals.

The caretaker robot is a semi-autonomous robot which is mainly designed to support the disabled and elderly people in their daily life activities, like providing the meal, giving necessary medication on time without any help from other people like therapists or nursing staff.

In Fire Bird series of robots Firebird V robot is the 5th series. Same main board and other accessories are used by all Firebird V series robot . Different family of microcontrollers can be added by simply changing the top microcontroller adapter board. Fire Bird V supports ATMEGA2560 (AVR), P89V51RD2 (8051) and LPC2148 (ARM7) microcontroller adapter boards. In this modularity changing the microcontroller adapter boards makes Fire Bird V robots very versatile. All Fire Bird V Robots share the same unified architecture. All Robots use the same main board and microcontroller adapter boards.

For programming the Firebird V ATMEGA2560 Robot we use AVR Studio from ATMEL which is feature rich free to IDE (Integrated Development Environment) for the robot. In this we are using AVR studio from the ATMEL in which at the back end WIN AVR uses open source C compiler. Built-in-Circuit Emulator and AVR instruction set simulator are some of its features. After writing and the checking the errors in program ".hex" file is produced. Using In System Programmer (ISP) ".hex" file is loaded onto the robot

III. PROPOSED WORK

***Block Diagram*:**

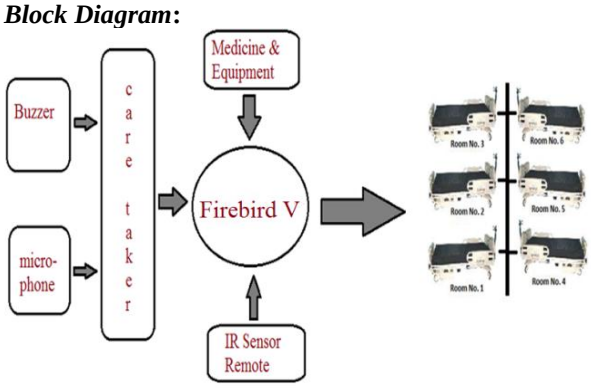

Fig 3.1: Block diagram of Caretaker Robot using Firebird V

- Fig shows the block diagram of Caretaker robot using Firebird V.

  - The patient's room is provided with a buzzer and a microphone with the help of which they can convey their message to a caretaker on what utilities they require.
  - Based on the patient's requirement the caretaker places the required utilities on the robot.
  - After placing the utilities on the robot the caretaker presses the IR push button with respect to the patient's ward number.
  - On the basis of the IR push button pressed the appropriate path is loaded on to the memory of the robot through an SQL server; the robot reaches the destination based on the predefined path.
  - While travelling from source to destination if it encounters any obstacle in its path then the buzzer turns on, the buzzer remains on till the obstacle is moved from its path.
  - Once it reaches the destination it stays there for a short period of time expecting the patient to collect the utilities, after a certain period of time it gets back to its source by retrieving its path that helped it reach the destination.

II. DESIGN METHODOLOGY:

In this project, we are using a Zigbee module for communication between the robot and the caretaker. Firebird V microcontroller is used to deliver the requested provisions by the patients in the hospitals. Since the path to the wards remains same in the hospitals, the predefined path are loaded on to the robot memory so that it can travel on those path with the help of white line sensing method when the button is pressed on the IR sensor remote. The path to the room is fed onto the robot memory through a SQL server. It takes the commands of 3 people at a time. They are not served based on priority but served based on number order i.e. in the ascending order Ex: If input is 5,2,3 then it will serve in 2,3,5 order. It consists of proximity sensor which detects the obstacle. In case if it encounter any obstacle then it starts to beep until the obstacle is removed or moved from its path. Once it successfully reaches destination it waits for certain period of time expecting a patient to pick the medicine or equipment and it reaches to its default room retrieving the path from its memory. We use several components in this:

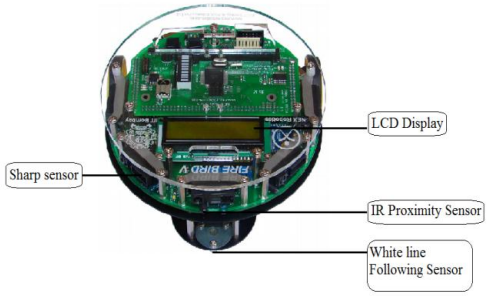

Fig 3.2: Firebird V ATMEGA 2560 robot

A. White line follower:

It is used for detecting white line on the ground surface. It consists of highly directional photo transistor for line sensing and bright red LED for the illumination. Photo diode is directional in nature so it does not get affected by ambient light unless it is very bright. When robot is not in white line the amount of light reflected is less, hence few leakage current flow through the photo transistor. The output of line sensor will be in the range of 2V to 3.3V. When the robot is on the white line more light reflects hence leakage current increases and voltage across sensor will be between 2V to 0.1V. Robot has 3 potentiometers for left, center and right side white line sensor.

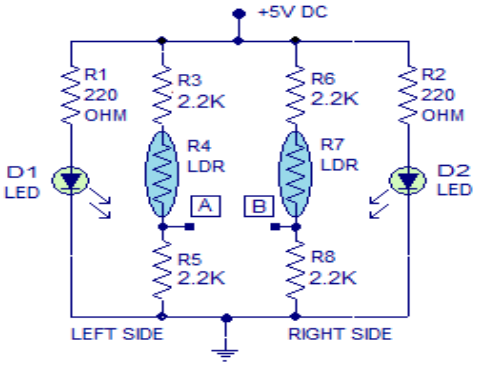

Fig 3.3: Circuit diagram for line following sensor

B. Position Encoder & Motion Control:

It gives position/velocity feedback to the robot. To control robots velocity and position it is used in closed loop. The position encoder has the slotted disc and it rotates between optical transmitter and receiver. When this slotted disc moves in between the optical transmitter and the receiver the square wave signal is obtained. The pulse count of this square wave signal indicates position and time period/frequency indicates velocity. The robot consists of IR led and photo transistors. When the slotted disc rotates it cuts IR illumination alternately because of which photo transistor gives square pulse train as output. Firebird V robot has two 75 RPM DC geared motors along with the third caster wheel for the support. The robot

speed is 24cm per second. The robot can be turned by turning one wheel in clockwise and others wheel in anticlockwise direction with zero turning radius. To give position feedback to the microcontroller the position encoders are mounted on both the motor's axles. The velocity and direction control is involved in motion control. Motors can be restrained by L293D duel motor driver which can provide 600mA of current to each motor. Velocity can be controlled by using pulse width modulation.

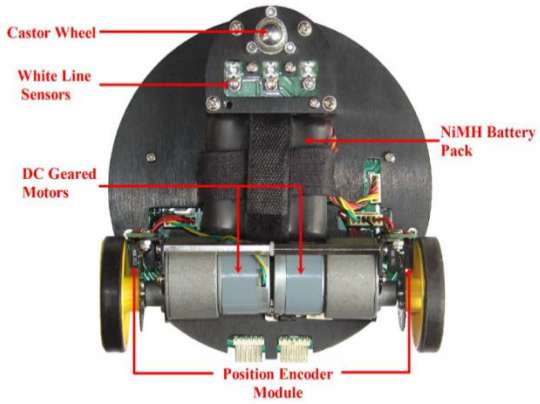

Fig 3.4: DC geared motors and position encoder

DIRECTION	LEFT BWD (LB) PA0 (L1)	LEFT FWD(LF) PA1 (L2)	RIGHT FWD(RF) PA2 (R1)	RIGHT BWD(RB) PA3 (R2)	PWM PL3 (PWML) for left motor PL4 (PWMR) for right motor
FORWARD	0	1	1	0	As per velocity requirement
REVERSE	1	0	0	1	As per velocity requirement
RIGHT *(Left wheel forward, Right wheel backward)*	0	1	0	1	As per velocity requirement
LEFT *(Left wheel backward, Right wheel forward,)*	1	0	1	0	As per velocity requirement
SOFT RIGHT *(Left wheel forward,, Right wheel stop)*	0	1	0	0	As per velocity requirement
SOFT LEFT *(Left wheel stop, Right wheel forward,)*	0	0	1	0	As per velocity requirement
SOFT RIGHT 2 *(Left wheel stop, Right wheel backward)*	0	0	0	1	As per velocity requirement
SOFT LEFT 2 *(Left wheel backward, Right wheel stop)*	1	0	0	0	As per velocity requirement
HARD STOP	0	0	0	0	As per velocity requirement
SOFT STOP (Free running stop)	X	X	X	X	0

Fig 3.5: Logic Table for Motor Direction Control

C. Obstacle Detection:

Sharp IR range sensors are used in robot to measure accurate distance. Sharp IR range sensors consist of IR led and linear CCD array. The IR led transmits a narrow IR beam. When the light hits the obstacle it reflects back to the linear CCD array the angle of reflected light is formed .This angle varies depending on the distance from the obstacle .Using the CCD array the angle of reflected light is measured to estimate distance from the obstacle , it gives out analog voltage corresponding to angle of reflection.

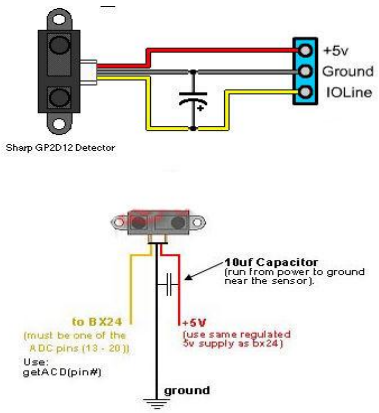

Fig 3.6: Circuit diagram of sharp IR range sensor.

D. IR Proximity Sensor:

Detection of any obstacles in the short range are done with the help of IR proximity sensor which has about 10cm sensing range. It sense the presence of the obstacles in the blind spot region of the Sharp IR range sensors. Fire Bird V robot has 8 IR proximity sensors.

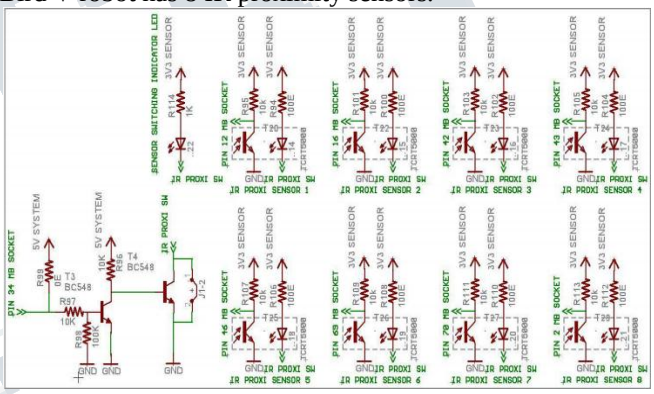

Fig 8: IR Proximity Sensors

In the absence of the obstacle there is no reflected light thus no leakage current will flow through the photo diode and voltage at the output of the photo diode will be around 3.3V, more light is reflected as it comes closer to an obstacle and the reflected light falls on the photo diode. Leakage current flowing through the photo diode starts to increase which leads the output voltage of photodiode to fall.

IV. RESULT

It has a very good efficiency level due to the use of correction algorithm.

Advantages:

[1] Robot is never tired or sick.
[2] It does not need salary.
[3] It will never mess any of an orders
[4] It won't be late for work or in low moods.
[5] Work can be done faster

Limitations:

[1] The robot does not serve on priority basis.
[2] Battery level isn't monitored.
[3] Robots require high cost for maintenance purpose

***Applications*:**

[1] Hospitals.
[2] Office.
[3] Home.

Acknowledgements

The current work was made possible because of the grant provided by **Vision Group On Science and Technology**, Department of Information Technology, Biotechnology and Science & Technology, Government of Karnataka, Grant No.VGST/CISEE/2012-13/GRD188/282. We acknowledge the VGST for sanctioning a grant amount of **Rs. 30 Lakhs** for the "Establishment of Innovative Robotics Awareness Lab" at **GSSS Institute of Engineering and Technology for Women**, Mysuru, Karnataka, India.

REFERENCE

[1] RM.Nachammai , N.Mrujool Kansara ,G.Lavanya ,R.Gopalakrishnan "White Line Follower Using FireBird V Robot" IJSRD-International Journal for Scientific Research and Development Vol. 3, Issue 10, 2015

[2] Rakesh Chandra Kumar , Md. Saddam Khan , Dinesh Kumar ,Rajesh Birua ,Sarmistha Mondal , ManasKr. Parai "OBSTACLE AVOIDING ROBOT – A PROMISING ONE" International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering Vol. 2, Issue 4, April 2013

[3] Deepak Punetha, Neeraj Kumar, Vartika Mehta "Development and Applications of Line Following Robot Based Health Care Management System" International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) Volume 2, Issue 8, August 2013

[4] Nor Maniha Abdul Ghani, Faradila Naim, Tan Piow Yon , "Two Wheels Balancing Robot with Line Following Capability," World Academy of Science, Engineering and Technology, pp-634-638, 2011.

[5] Colak, I., Yildirim, D.,"Evolving a Line Following Robot to use in shopping centers for entertainment",Industrial Electronics, 2009. IECON '09. 35th Annual Conference of IEEE,pp.3803 - 3807,3-5 Nov. 2009.

[6] Clifford A. Shaffer and Gregory M. Herb "A Real-Time Robot Arm Collision Detection System" IEEE Transaction on Robotics and Automation. VOL 8. NO. 2. April 1992.

[7] https://github.com/eyantra/Autonomous_Waiter_Robot_using_Firebird_ATmega2560/blob/master/Documetation/Autonomous_Waiter_Robot.pdf

[8] S. CameronMcDonnell Douglas Research Laboratories, St.Louis, "A study of the clash detection problem in robotics" Robotics and Automation. Proceedings. 1985 IEEE International Conference on (Volume:2)

[9] http://www.scribd.com/doc/293080638/White-Line-Follower-Using-Fire-Bird-V-Robot

[10] https://www.researchgate.net/publication/277205656_Development_and_Applications_of_Line_Following_Robot_Based_Health_Care_Management_System