

Introduction to Firebird-V Robotics Research Platform

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IIT Bombay
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Agenda for Discussion

1 Introduction to Robotics

- Major Components of a Robot

2 Introduction to FireBird Platform

- Firebird V 8051 Platform
- Firebird V AVR Platform
- Firebird V ARM Platform

3 Introduction to FireBird ATmega-2560 Platform

- Major Components of a Robot
- Sensors
- Actuators
- Control
- Intelligence
- Power
- Communication
- Indicating Devices
- Block Diagram



Major Building Blocks of Robot

What are the Major Components needed for Designing a Robot?



Major Building Blocks of Robot

What are the Major Components needed for Designing a Robot?

- 1 Sensors: For Sensing the environments



Major Building Blocks of Robot

What are the Major Components needed for Designing a Robot?

- 1 Sensors:** For Sensing the environments
- 2 Actuators:** For Movement of robots and its parts



Major Building Blocks of Robot

What are the Major Components needed for Designing a Robot?

- 1** Sensors: For Sensing the environments
- 2** Actuators: For Movement of robots and its parts
- 3** Control: Controller/Processor as brain of Robot



Major Building Blocks of Robot

What are the Major Components needed for Designing a Robot?

- 1** Sensors: For Sensing the environments
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- 3** Control: Controller/Processor as brain of Robot
- 4** Intelligence: User Written Command to perform desired set of action



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- 4** Intelligence: User Written Command to perform desired set of action
- 5** Power: A necessity for making a system work



Major Building Blocks of Robot

What are the Major Components needed for Designing a Robot?

- 1 Sensors:** For Sensing the environments
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- 4 Intelligence:** User Written Command to perform desired set of action
- 5 Power:** A necessity for making a system work
- 6 Communication:** Robot can talk to another robot/PC



outline
Introduction to Robotics
Introduction to FireBird Platform
Introduction to FireBird ATmega-2560 Platform

Firebird V 8051 Platform
Firebird V AVR Platform
Firebird V ARM Platform

Flavors of Firebird Robots



Flavors of Firebird Robots

- 1 Configuration-1:
Master: P89v51RD2 Slave: optional



Flavors of Firebird Robots

1 Configuration-1:

Master: P89v51RD2 Slave: optional

2 Configuration-2:

Master: ATmega 2560 Slave: ATmega 8



Flavors of Firebird Robots

① Configuration-1:

Master: P89v51RD2 Slave: optional

② Configuration-2:

Master: ATmega 2560 Slave: ATmega 8

③ Configuration-3:

Master: LPC 2148 Slave: 2 x ATmega 8



outline
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Firebird V 8051 Platform
Firebird V AVR Platform
Firebird V ARM Platform

Firebird V P89v51RD2 Platform



Firebird V P89v51RD2 Platform



Firebird V P89v51RD2 Platform



- 1 This Platform has 8051 architecture based adaptor board.



Firebird V P89v51RD2 Platform



- 1** This Platform has 8051 architecture based adaptor board.
- 2** Microcontroller used is Philips manufactured P89v51RD2 as master.



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Firebird V ATmega2560 Platform



Firebird V ATmega2560 Platform



Firebird V ATmega2560 Platform



- 1 This Platform has AVR architecture based adaptor board.



Firebird V ATmega2560 Platform



- 1** This Platform has AVR architecture based adaptor board.
- 2** Microcontroller used is Atmel manufactured ATmega2560 as master.



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Firebird V LPC 2148 Platform



Firebird V LPC 2148 Platform



Firebird V LPC 2148 Platform



- 1 This Platform has ARM-7 architecture based adaptor board.



Firebird V LPC 2148 Platform



- 1** This Platform has ARM-7 architecture based adaptor board.
- 2** Microcontroller used is Philips manufactured LPC2148 as master.



Major Building Blocks of Robot

The Major Components needed for Designing a Robot

- Sensors: For Sensing the environments
- Actuators: For Movement of robots and its parts
- Control: Controller/Processor as brain of Robot
- Intelligence: User Written Command to perform desired set of action
- Power: A necessity for making a system work
- Communication: Robot can talk to another robot/PC



Sensors on Firebird V Platform

1. Sharp IR Range Sensors



Sensors on Firebird V Platform

1. Sharp IR Range Sensors



- 1 Transmitter: IR LED
Receiver: CCD Array



Sensors on Firebird V Platform

1. Sharp IR Range Sensors



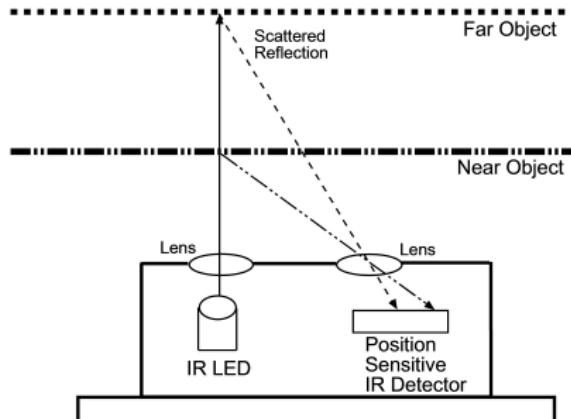
1 Transmitter: IR LED
Receiver: CCD Array

2 Count on Firebird: 05



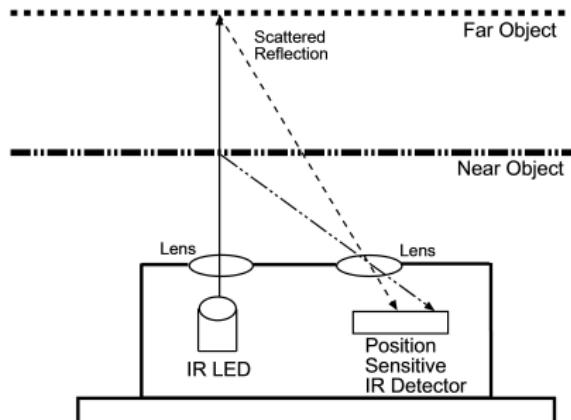
Sensors on Firebird V Platform (cont.)

Working of Sharp Sensor



Sensors on Firebird V Platform (cont.)

Working of Sharp Sensor



a



Sensors on Firebird V Platform (cont.)

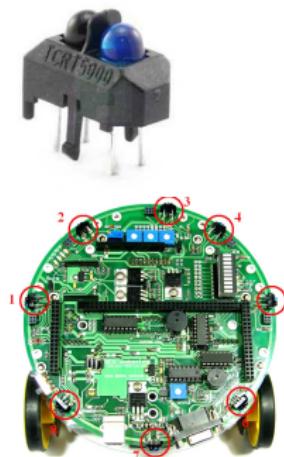
2. IR Proximity Sensors



Sensors on Firebird V Platform (cont.)

2. IR Proximity Sensors

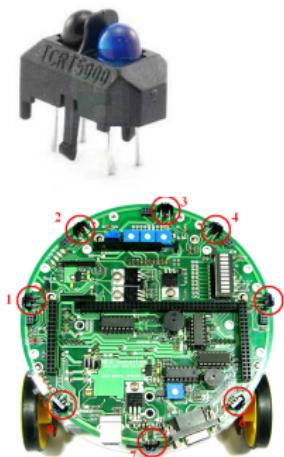
1 Transmitter: IR LED
Receiver: Phototransistor



Sensors on Firebird V Platform (cont.)

2. IR Proximity Sensors

- 1** Transmitter: IR LED
Receiver: Phototransistor
- 2** Count on Firebird: 08



Electronic Components

Some of the small components used in the sensors attached to the Robot are:

- IR LED
- Phototransistor



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Electronic Components(Cont.)



¹<http://letsmakerobots.com/node/33031>

Electronic Components(Cont.)

■ IR LED

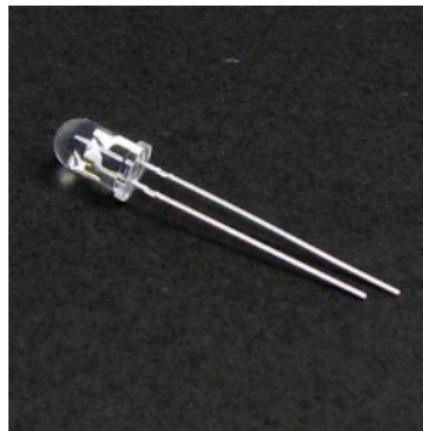
¹<http://letsmakerobots.com/node/33031>



Electronic Components(Cont.)

■ IR LED

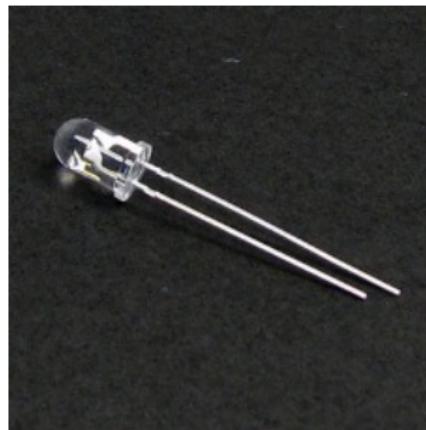
An IR LED / IR Transmitter is a special purpose LED that transmits Infrared rays.



Electronic Components(Cont.)

■ IR LED

An IR LED / IR Transmitter is a special purpose LED that transmits Infrared rays.



1



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Electronic Components(Cont.)

²<http://learn.parallax.com/lightspectrum>



Electronic Components(Cont.)

■ Phototransistor

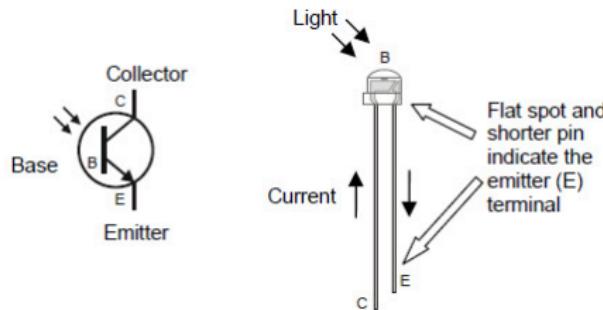
²<http://learn.parallax.com/lightspectrum>



Electronic Components(Cont.)

■ Phototransistor

Phototransistor is a light- activated device which is widely employed as a receiver in many applications. It is basically a bipolar transistor enclosed in a glass casing and has a much greater sensitivity as compared to a photodiode.



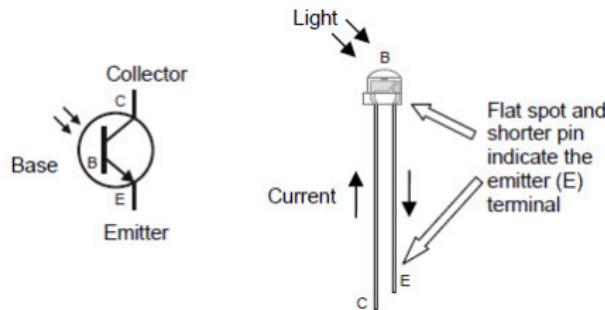
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Electronic Components(Cont.)

■ Phototransistor

Phototransistor is a light- activated device which is widely employed as a receiver in many applications. It is basically a bipolar transistor enclosed in a glass casing and has a much greater sensitivity as compared to a photodiode.



2



Sensors on Firebird V Platform (cont.)

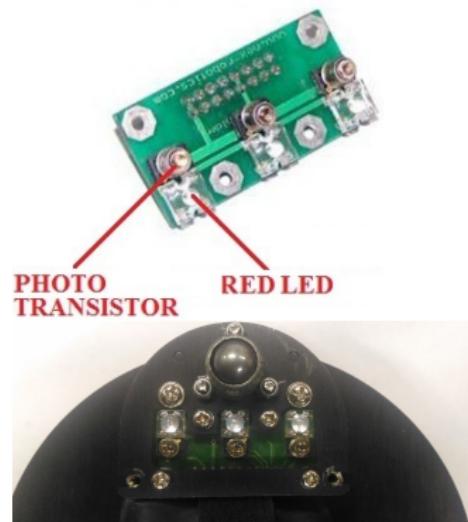
3. White Line Sensor



Sensors on Firebird V Platform (cont.)

3. White Line Sensor

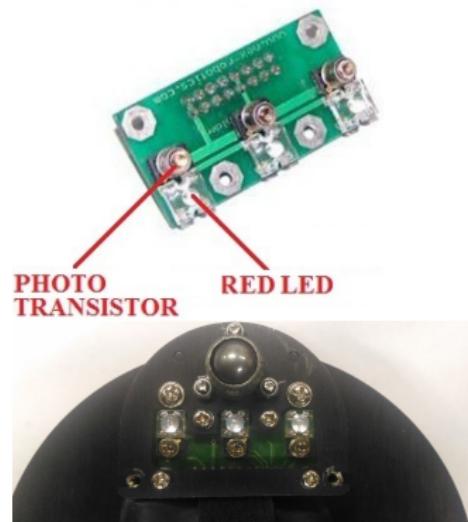
- 1 Transmitter: Red LED
Receiver: Phototransistor



Sensors on Firebird V Platform (cont.)

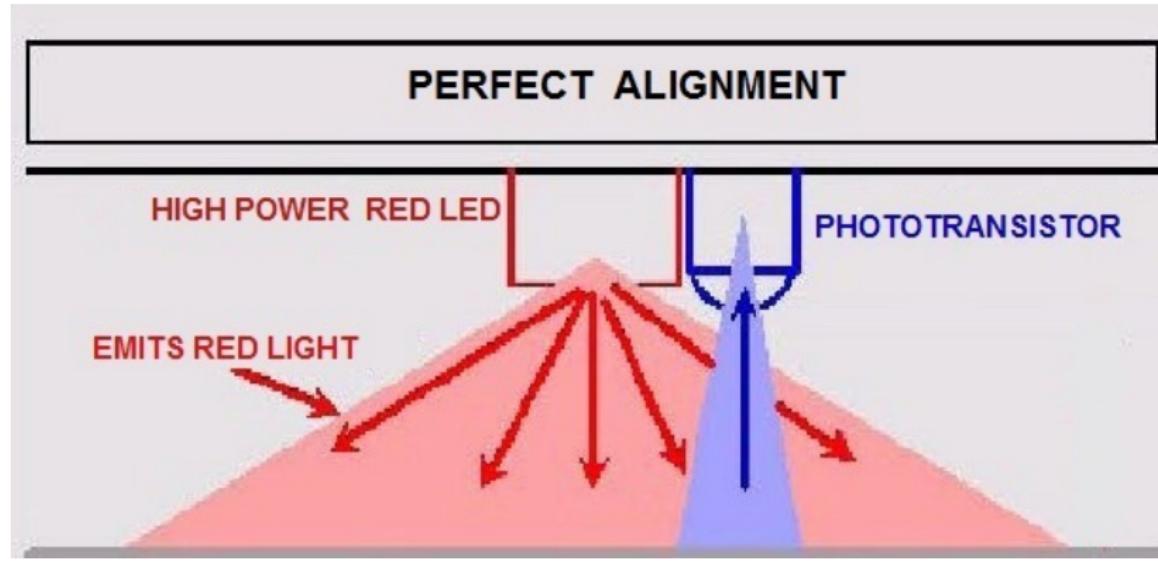
3. White Line Sensor

- 1** Transmitter: Red LED
Receiver: Phototransistor
- 2** Count on Firebird: 01



Sensors on Firebird V Platform (cont.)

Working of Whiteline Sensor



Sensors on Firebird V Platform (cont.)

4. Position Encoder



Sensors on Firebird V Platform (cont.)

4. Position Encoder

- 1 Transmitter: IR Transmitter
Receiver: Phototransistor



Sensors on Firebird V Platform (cont.)

4. Position Encoder

- 1** Transmitter: IR Transmitter
Receiver: Phototransistor
- 2** Count on Firebird: 02



Sensors on Firebird V Platform (cont.)

5. Infrared TSOP Receiver



Sensors on Firebird V Platform (cont.)

5. Infrared TSOP Receiver



1 Receiver: Phototransistor



Sensors on Firebird V Platform (cont.)

5. Infrared TSOP Receiver



- 1** Receiver: Phototransistor
- 2** TSOP1738



Sensors on Firebird V Platform (cont.)

5. Infrared TSOP Receiver



- 1** Receiver: Phototransistor
- 2** TSOP1738
- 3** Count on Firebird: 01



Sensors on Firebird V Platform (cont.)

6. Servo Mounted Sensor Pod



Sensors on Firebird V Platform (cont.)

6. Servo Mounted Sensor Pod

- 1** Purpose: Mount Camera or Sensor



Sensors on Firebird V Platform (cont.)

6. Servo Mounted Sensor Pod

- 1** Purpose: Mount Camera or Sensor
- 2** Count on Firebird: Optional Add-on Module



Sensors on Firebird V Platform (cont.)

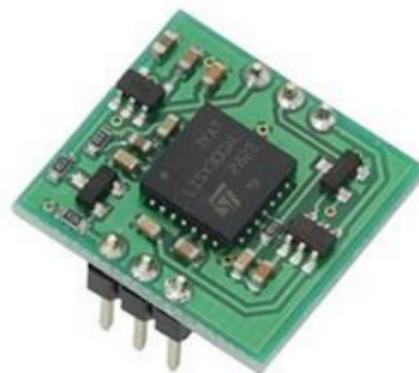
7. Accelerometer



Sensors on Firebird V Platform (cont.)

7. Accelerometer

- 1 Accelerometer is used for measuring acceleration in particular direction



Sensors on Firebird V Platform (cont.)

7. Accelerometer

- 1** Accelerometer is used for measuring acceleration in particular direction

- 2** Count on Firebird: Optional Add-on Module



Sensors on Firebird V Platform (cont.)

8. Gyroscope



Sensors on Firebird V Platform (cont.)

8. Gyroscope

- 1 Gyroscope are devices used for providing stability and maintain fixed orientation



Sensors on Firebird V Platform (cont.)

8. Gyroscope

- 1** Gyroscope are devices used for providing stability and maintain fixed orientation

- 2** Count on Firebird: Optional Add-on Module



Sensors on Firebird V Platform (cont.)

9. Ultrasonic Sensor



Sensors on Firebird V Platform (cont.)

9. Ultrasonic Sensor

- 1** Ultrasonic sensor is used for object detection



Sensors on Firebird V Platform (cont.)

9. Ultrasonic Sensor

- 1** Ultrasonic sensor is used for object detection

- 2** Count on Firebird: Optional. An Add-on Module



Sensors on Firebird V Platform (cont.)

10. Motion Sensor



Sensors on Firebird V Platform (cont.)

10. Motion Sensor

- 1 PIR Motion Sensor is used for detecting motion of live object.



Sensors on Firebird V Platform (cont.)

10. Motion Sensor

- 1** PIR Motion Sensor is used for detecting motion of live object.

- 2** Count on Firebird: Optional Add-on Module



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Sensors on Firebird V Platform (cont.)



Sensors on Firebird V Platform (cont.)

11. Global Positioning System(GPS)

- 1** GPS module are devices which receives GPS signal to locate itself on earth



Sensors on Firebird V Platform (cont.)

11. Global Positioning System(GPS)

- 1** GPS module are devices which receives GPS signal to locate itself on earth
- 2** GPS module gives latitude and longitude information



Sensors on Firebird V Platform (cont.)

11. Global Positioning System(GPS)

- 1** GPS module are devices which receives GPS signal to locate itself on earth
 - 2** GPS module gives latitude and longitude information
 - 3** Count on Firebird: Optional Add-on Module



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Actuators



Actuators

1 Two 60 RPM DC Geared Motor



2 Servo Motors



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Control Room of Robot



Control Room of Robot

- 1 ATMEL Manufactured AVR architecture based ATmega 2560 microcontroller



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How is Robot Made Intelligent



How is Robot Made Intelligent

- 1** Language used for programming: EMBEDDED 'C'
- 2** EMBEDDED 'C' similar to C.



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Powering the Robot



Powering the Robot

- 1** Battery Powered: 9.6V, 2100mAH, NiMH battery



- 2** Auxillary Power: 12V, 1A Adaptor



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Communication



Communication

- ✓ Wired Communication: Between Robot and System



Communication

- ✓ Wired Communication: Between Robot and System
- ✓ USB; RS-232 Serial; USB-to Serial



Communication

- ✓ Wired Communication: Between Robot and System
- ✓ USB; RS-232 Serial; USB-to Serial



- ✓ Wire-less Communication: Between Robot and System and Robot and Robot



Communication

- ✓ Wired Communication: Between Robot and System
- ✓ USB; RS-232 Serial; USB-to Serial



- ✓ Wire-less Communication: Between Robot and System and Robot and Robot
- ✓ X-bee based on IEEE 802.15.4 Protocol



Communication

- ✓ Wired Communication: Between Robot and System
- ✓ USB; RS-232 Serial; USB-to Serial



- ✓ Wire-less Communication: Between Robot and System and Robot and Robot
- ✓ X-bee based on IEEE 802.15.4 Protocol



- ✓ Infrared Remote



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Indicating Devices



Indicating Devices

- ✓ 16x2 Alpha numeric LCD



Indicating Devices

- ✓ 16x2 Alpha numeric LCD



Indicating Devices

- ✓ 16x2 Alpha numeric LCD



- ✓ Buzzer



Indicating Devices

- ✓ 16x2 Alpha numeric LCD



- ✓ Buzzer



Indicating Devices

- ✓ 16x2 Alpha numeric LCD



- ✓ Buzzer



- ✓ Bar-LED



Indicating Devices

- ✓ 16x2 Alpha numeric LCD



- ✓ Buzzer



- ✓ Bar-LED



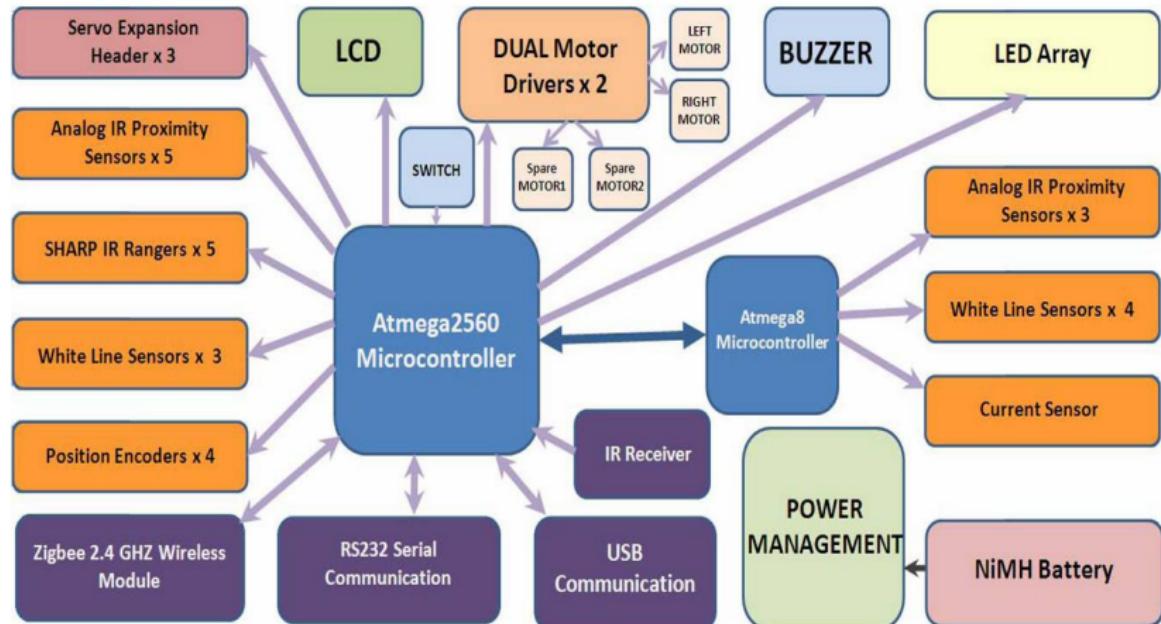
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Block Diagram of ATmega2560 based Robot



Block Diagram of ATmega2560 based Robot



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Thank You!

