CASE STUDY REPORT

BEAM ROBOTICS

XCSHA-3

INTRODUCTION TO MEACHINE LEARNING

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BEAM ROBOTICS

Introduction:-

**BEAM robotics** is a style of robotics that emphasizes simplicity, analog circuits, and behavior-based design. The acronym **BEAM** stands for:

* **B**iology
* **E**lectronics
* **A**esthetics
* **M**echanics

BEAM robots are often inspired by biological systems and are designed to exhibit lifelike behaviors using simple circuits and minimal programming, or even no programming at all.

**Key Principles of BEAM Robotics**

1. **Biologically Inspired Behavior**  
   BEAM robots mimic natural organisms. For example, they may act like insects—responding to light, avoiding obstacles, or seeking out power sources like a plant would seek sunlight.
2. **Simple Analog Electronics**  
   BEAM robots typically use analog electronics (rather than digital microcontrollers). These circuits rely on components like transistors, capacitors, resistors, and sometimes small microcontrollers for hybrid designs.
3. **Aesthetic and Mechanical Simplicity**  
   The design aims for elegance and efficiency in mechanical and electrical construction. Many BEAM bots are built from recycled components and use solar cells for power.
4. **Behavior-Based Robotics**  
   Instead of following a pre-defined sequence of commands, BEAM robots respond to environmental stimuli (light, sound, touch, etc.) in real time. Their behavior "emerges" from the interaction between the hardware and the environment.

### Types of BEAM Robots

1. **Photovores** – Seek out light sources (like a plant reaching for the sun).
2. **Photophobes** – Avoid light.
3. **Symets** – Simple solar-powered robots that move in bursts when they collect enough energy.
4. **Turbots** – Robots that tumble or roll using simple mechanisms.
5. **Walkers** – Robots that use legged locomotion, often inspired by insects or spiders.
6. **Climbers** – Designed to move up and down ropes or other surfaces.

### Typical BEAM Components

* **Solar panels or small batteries**
* **Motors (vibration, pager, gear motors)**
* **Sensors (light-dependent resistors, touch sensors)**
* **Transistors (e.g., 2N3904, 2N3906)**
* **Capacitors and resistors**
* **555 timers or custom analog logic**

### Advantages of BEAM Robotics

* Low cost and low complexity
* No need for programming (in purely analog designs)
* Encourages learning through experimentation
* Highly customizable and modifiable

### Limitations

* Limited decision-making capability
* Harder to scale to complex behaviors compared to digital systems
* Troubleshooting analog circuits can be challenging for beginners

### Applications

While BEAM robots are not generally used in industrial or commercial settings, they are excellent educational tools. They're used in:

* **STEM education** and hands-on workshops
* **Art installations** and robotic sculptures
* **Hobbyist projects** and DIY robotics