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## Mobile Robotics at Your Fingertips: Smartphone-Controlled Educational Bot

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### Abstract

Mobile robotics has gained significant attention in both educational and research settings. This article presents an in-depth exploration of the "SmartBot," a cutting-edge smartphone-controlled educational robot designed to enhance robotics education and research opportunities. We delve into its key features, applications, and the potential impact it has on the field of robotics. Our main goal was to develop a low-cost mobile robot, which is cheaper than most commercial robots sold today and can find application not only in education and research, but also in other applications. This mobile robot was developed by designing and implementing a chassis having a Raspberry Pi controller programmed in C language in a Debian Linux-based OS that was used to control the chassis remotely via a Wi-Fi network. A mobile application was loaded into an Android smartphone with an easy-to-use graphical user Interface (GUI). Captured footages are sent wirelessly via Wi-Fi to the Android smartphone and it is stored in the local memory of the smartphone.

### Introduction

Mobile robots have become increasingly relevant in various domains, including education and research. The integration of smartphones into the control and navigation of mobile robots has opened new avenues for interactive and engaging learning experiences. This article introduces the "SmartBot," a smartphone-

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controlled educational robot that aims to bridge the gap between theoretical knowledge and practical application in the field of robotics.

In a bid to feed the minds and educate these young ones on how these robots are made and operated either manually or autonomously, this robot was designed and developed. Having a cost-effective mobile robot with a simple approach to design and implementation will definitely boost the interest of students in science, technology, engineering, and math (STEM), as well as a beginner's guide to post-secondary students who have interest in robotics without making it too ambiguous to learn. Mobile robots find application in many areas of life, ranging from; learning and research centres, to home application for daily chores, to medical field, to space exploration, to agricultural sector, and also in surveillance of both public and private spaces.

Surveillance is the monitoring of behavior, activities, or other changing information with the intention of influencing, managing, directing, or protecting persons, process, or assets. Surveillance is used by governments in intelligence gathering, prevention of crime, safety of person(s), objects or process, or the investigation of crime. Advances in technology over the years have made it possible to monitor areas of importance remotely by using robots in place of humans. Apart from the clear advantage of not losing any work force, physical, and space robots we can detect subtle elements that are not evident to people.

Robots are machines that are operated automatically and used to replace human efforts, although they may not perform functions exactly or look physically similar to human beings. Robotics by extension is an engineering discipline that deals with the design, construction, operation, and maintenance of robots. A mobile robot is simply a robot that runs on software and is capable of moving around within its environment with the help of sensors.

### **The SmartBot: A Closer Look**

#### **Hardware Overview**

The SmartBot is a compact, programmable robot equipped with a variety of sensors, actuators, and a user-friendly interface. It's hardware components include wheels for mobility, a camera for vision-based tasks, infrared and ultrasonic sensors for obstacle avoidance, and Wi-Fi connectivity for smartphone interaction.



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## **Smartphone Control**

The unique feature of the SmartBot is its smartphone-controlled operation. Users can easily connect to the robot via a dedicated mobile app, allowing them to control its movement, interact with the environment, and even program custom behaviors using an intuitive graphical interface.

## **Applications in Education**

### **Interactive Learning**

The SmartBot offers a hands-on approach to robotics education, engaging students in real-world problem-solving scenarios. With its smartphone interface, students can experiment with robotics concepts, enhancing their understanding of control systems, sensors, and algorithms.

### **Programming Proficiency**

The robot supports various programming languages, from beginner-friendly block-based coding to more advanced languages like Python. This flexibility enables students to tailor their learning experience to their skill level.

### **Multidisciplinary Learning**

SmartBot's smartphone control fosters multidisciplinary learning, allowing educators to integrate robotics into diverse subjects such as mathematics, physics, computer science, and even art. Students can work on projects that involve data collection, image processing, and creative robot art.

### **Research Opportunities**

#### **Experimental Platform**

In research, the SmartBot serves as an affordable and versatile platform for testing and validating robotics algorithms. Researchers can experiment with localization, mapping, and navigation algorithms in real-world conditions, thanks to its mobility and sensor suite.

#### **Collaborative Research**

The SmartBot's user-friendly interface encourages collaborative research efforts. Multiple robots can be controlled and coordinated from a single smartphone, enabling researchers to conduct experiments in swarm robotics, human-robot interaction, and more.



## Impact and Future Prospects

The introduction of the SmartBot into educational and research settings has the potential to transform the way we approach robotics. By making robotics accessible, interactive, and engaging, it empowers students and researchers alike. The smartphone-controlled educational bot offers a stepping stone to nurture the next generation of roboticists and advance our understanding of mobile robotics.

## Conclusion

The "SmartBot" represents a significant leap forward in mobile robotics education and research. By bringing robotics to users' fingertips through smartphone control, it opens doors to innovative and multidisciplinary applications, nurturing a new generation of robot enthusiasts and advancing the field of robotics research. As this technology continues to evolve, we can expect even more exciting developments in the world of mobile robotics.

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