Understanding of Android-Based Robotic and Game Structure

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Abstract. The development of an android with impressive lifelike appearance and behavior has been a long-standing goal in robotics and a new and exciting approach of smartphone-based robotics for research and education. Recent years have been progressive for many technologies, which allowed creating such androids. There are different examples including the autonomous Erica android system capable of conversational interaction and speech synthesis technologies. The behavior of Android-based robot could be running on the phone as the robot performed a task outdoors. In this paper, we present an overview and understanding of the platform of Android-based robotic and game structure for research and education.

1 Introduction
In recent years, androids have become increasingly the popular media and visible device. Android is a Linux based operating system; it is designed primarily for touch screen mobile devices such as smart phones and tablet computers. The operating system (OS) has been improved a lot in last 15 years starting from black and white phones to recent smart phones or mini computers. Nowadays, one of the most widely used mobile OS is android. The android is software that was founded in Polo Alto of California in 2003 [1].

1.1 System Integration
Smart phones and cloud computing were introduced to automation industry as components of connected enterprise integration system. The established protocols and interfacing done in that area in addition to the rapid growth of the hardware specification of those devices were behind the motivation to think of smart phones as programming and simulation devices.

1.2 Related work
Human-robot collaboration has been a significant research topic since the beginning of robotics. The constant introduction of robots in industrial environments, the creation of new compliant robots and the sensors available nowadays in the market (cheaper and more accurate) make human-robot interaction an even more active and exciting research subject [2].

1.3 Humanoid robot
A humanoid robot is a robot with its body shape built to resemble the human body. The design may be for functional purposes such as interacting with human tools and environments, for experimental purposes such as the study of means of locomotion or for other purposes. In general, humanoid robots have a torso, a head, two arms, and two legs; though some forms of humanoid robots may model only
part of the body, for example, from the waist up. Some humanoid robots also have heads designed to replicate human facial features such as eyes and mouths. Androids are humanoid robots built to resemble humans aesthetically [3].

2 Platform Architecture

2.1 ERICA platform

There are many variations of Japanese robotics. Erica is an android developed as a research platform for the autonomous conversational robot (Figure 1). Developing total technology to enable Erica to have natural interaction with persons by integrating various technologies such as voice recognition, human tracking and natural motion generation. It has nineteen degrees of freedom for face, neck, shoulder, and waist; it can express various facial expressions and some gestural motions. Its appearance is designed for beautiful and neutral female face, by which people can familiarly interact with it. It speaks in synthesized voice [4].

![Figure 1. Autonomous conversational robot Erica.](image1)

Currently, the project is in an early phase, so Erica’s high-level conversational capabilities are still quite limited. However, the robot platform has been completed, and Erica was recently unveiled in a public demonstration showcasing the basic functionalities of the platform. During the demonstration, it autonomously answered questions from reporters and conducted conversations while demonstrating a rich set of nonverbal behaviour.

2.2 Android based robotic platform

The android based robotics platform was originally developed by Nicolas Oros and Jeffrey Krichmar. Android-based robotics provides an inexpensive platform for robotic control coupling the powerful capabilities of Android smartphones with off-the-shelf robotic components. Examples of its use include academic research in cognition and robotics, robotics competitions, classroom instruction, and personal project (Figure 2) [5].

![Figure 2. Android Based Robotic platform.](image2)
2.3 Hardware and software

- **Hardware**
  An important advantage of using a smartphone for an on-board computer is that the size of a robot can be kept relatively small while preserving great features. Its cost can also be minimal since the phone itself can handle computation, sensing and battery power.

  Many different phones are now available on the market. Before purchasing an Android phone to be used as an on-board computer for a robot, one has to consider the ways of use and needs of that particular robot. For example, the HTC Google Nexus One can be found unlocked for less than $200, and is a suitable on-board computer.

- **Software**
  The Android operating system is open source and Linux-based. Programmers can develop software for Android in Java using the SDK [4–6] or in native language (C/C++) using the native development kit (NDK). It is also possible for developers to modify the Linux kernel if needed. Implementation of an Android application can be achieved using the Eclipse IDE with the Android Development Tools (ADT) plug-in.

  Using this SDK, the developer has easy access to different functionalities of an Android phone such as graphical interfaces, multi-threading, networking, data storage, multimedia, sensors, location provider, speech-to-text, text-to-speech and more [6].

3 Course of designing game

Game design is the art of applying design and aesthetics to create a game for entertainment or for educational, exercise, and experimental purposes. Increasingly, elements and principles of game design are also applied to other interactions, particularly virtual ones.

Academically, game design is a part of game studies, while game theory studies strategic decision making (primarily in non-game situations). Games have historically inspired seminal research in the fields of probability, artificial intelligence, economics, and optimization theory. Applying game design to itself is a current research topic in meta-design [7].

3.1 Game development

To develop games for Android, you need a PC running a version of either Linux, Windows, or Mac OS that meets the requirements for both the Android SDK and the Java Development (JDK). Both the SDK and JDK are freely available from their respective websites, where you can find more details about specific requirement. Android also uses the Eclipse IDE (integrated development environment).

  Working knowledge of Java and XML are helpful, but not necessary. If you are familiar with any high-level language and development environment, you should be fine. If not, you should still be able to work through the examples and put together workable games.

  If you are interested in developing for Android, you probably have an Android device, but you do not necessarily need one. The Android SDK provides an emulator, which lets you configure virtual devices to test your games without the actual hardware.

  However, testing playability without actual devices is not advised. Especially if you are designing for multiple form factors, such as both phones and tablets, you will probably want to invest in at least a couple of test devices.

3.2 Game architecture

Games have a different architecture and control flow than apps. Both seem to respond to user input instantly, but while an app does this by setting listeners and reacting to events with method call (most commonly the onClick method calls the OnClickListener), this approach is not valid for a real-time game (although it is valid for non-real-time games).

  Once a game is running, it must evaluate and update everything as fast as possible. This is the reason why it cannot be interrupted by user events. Those events or states should be recorded instead and then read by the game objects during its update (Figure 3) [8].
4 Robotics in Lao

Engineering students compete for robotics prize. According to the National University of Lao, the faculty of engineering is encouraging students to gain science and technology experience by giving them the opportunity to design and build robots so that they can demonstrate their achievements in the field of robotics.

Currently, in Lao PDR, the reported and promoted information in the field of science and technology is not enough. Therefore, we have the goal of developing a web and mobile portal in order to provide Lao people with an opportunity to get access to information and resources that can be useful and easily reached [9–11]. In addition, science and technology information and resources will enable integration of Lao people to the scientific society.

5 Conclusion

The paper presents a promising trend in robotics, which leverages smartphone technology. These smartphone robots are ideal for hobbyists, educators, students and searchers. The paper describes smartphone-based robotic projects and demonstrates the relatively easy and inexpensive construction of an Android-based robotic platform.

Acknowledgments

This study (research grant No № 8.2.24.2018) was supported by the Tomsk State University competitiveness improvement programme.

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