Negatives of Android Phone/Arduino

Risk
How do you know that our architecture could handle this timing?
If we need to access specific hardware on the phone can we do that?
Is there expandability that does not involve adding another microcontroller?
What if we find Bluetooth COMs to not be really reliable?
There is only one USB port on Android.
Can we prioritize interrupts within Android?

Positives

Others
We need to find out if there is code to access the USB port directly from Androids side.
Is there code for Arduino USB stack?
Research expandability through wireless, Bluetooth and Ethernet to USB devices.
Do concept selection on different types of architectures? (Android doing all processing, Arduino just a COMs router) (Android doing as little as possible, Arduino doing more)
(Using Bluetooth or Wireless to transfer data from Android to Arduino)
Can we prioritize interrupts within Android?
C/C++ Compiler
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Risk

All this research needs to be done to find out if Android is a good way to go. If not way more research needs to be done for small form factor PCs. Sff PCs will be used because they are easier to use than dev boards such as BeagleBoard.

After talking to Kevin and Colin, several problems were brought up with the Android/Arduino setup. These included timing constraints not being meant due to the architecture of the system. For example, fall resistance may need to be fast like 5ms.

How do you we know that our architecture could handle this timing?

There is not much research we can do here involving Android. First, Android is not a RTOS (http://androidforums.com/android-lounge/198528-android-rtos.html) but you can notice lags sometimes. When typing a text message you sometimes notice the screen freezes. This should be fine for our application because it is not a dependable RTOS project. The fastest time that will need to be handled in the system is the fall resistance. The good thing about this is Android phones have the sensors for this. How fast should the system respond to a push. I think anything less than a second is good. I am pretty sure the system could respond within 10ms.

Look for outside sources on response time for fall detection.

The above source talks about accurate and fast fall detection using gyros and accelerometers. They same at 120Hz or 8.33ms. From my experience with the NXT, Bluetooth can be sampled at 5ms reliable. Therefore, using Bluetooth is feasible to detect falls which relate to the fast processing needed in our system.

If we need to access specific hardware on the phone can we do that?

This site talks about the USB port on Android phones and converting to serial. They say that converters need drivers. What this means is that Android needs the drivers for those converters. In-order to get drivers for those converters Android kernels need to be recompiled. Some manufactures of phones limit their kernels source code.
Approaching this the other way, meaning Android is the host USB, would involve jumping through hoops to make Android recognize that it is the host USB. Plus we then need to find Arduino USB stack code.

http://code.google.com/p/android-serialport-api/
This is serial port api for android using HTC Linux TTy serial ports. This does not support RS-232.

USB host mode can be done according to

Is there expandability that does not involve adding another microcontroller?

What if we find Bluetooth COMs to not be really reliable?

There is only one USB port on Android.

http://slickdevlabs.com/slick-usb-2-serial-library/
enables the use of common USB to serial adapters with devices running Android 3.1 and above that support USB host mode.

Seems to be ok to add new devices on this page?

Can we prioritize interrupts within Android?

Positives

There were a few positives. Android phones have way more people developing and using these phones than small form factor PCs or even dev boards. Because of this, it would be a lot easier to find information and integrate it into our project. This is a integration project and we don’t know how easy it will be to integrate with a ssf or dev board. Learning curve is faster compared to small form factor PCs or dev boards.
Others

We need to find out if there is code to access the USB port directly from Android's side.

Is there code for Arduino USB stack?
Not sure if this answers the question. But this looks useful for connecting a phone with an Arduino controller through USB..

Research expandability through wireless, Bluetooth and Ethernet to USB devices.

Do concept selection on different types of architectures? (Android doing all processing, Arduino just a COMs router) (Android doing as little as possible, Arduino doing more) (Using Bluetooth or Wireless to transfer data from Android to Arduino)

Can we prioritize interrupts within Android?

C/C++ Compiler
https://market.android.com/details?id=com.n0n3m4.droidc&hl=en
It looks like there is a C compiler and if there is enough memory a C++ compiler can be supported also.
Real-Time

http://www.igmagazineonline.com/current/pdf/Pg43-45_IQ_32-Android_on_a_Highly_Reliable_Real-Time_OS.pdf
This website talks about replacing the kernel of the Android OS with a real time one that works on ARMs. This would assume we are using a different platform than a phone.

http://www.eetimes.com/design/embedded/4008876/Android-Linux--Real-time-Development-for-Embedded-Systems
This article talks further about how Android can be used with another RTOS to provide the functionality needed.

Gaining more access to the phone

This talks about rooting your phone or gaining admin priviileges to the phone to do such things as relocating cache, and accessing maps, calendars and clocks, add linux binaries.

Connection to Android Phone USB

There are ways to connect to Android Phone through USB. These ways are all based off of Android Debug Bridge (ADB). Basically, ADB gives you access to the phone through a shell or using some other communication such as TCP sockets. There are several project that took advantage of this.

Microbridge

http://code.google.com/p/microbridge/
This project adds functionality to the ADB. There also seems to be a library for Arduino. The downside to this project is the fact that three additional parts need to be purchased: Arduino, USB host shield and a USB cable. This also involves connections both in hardware in software. In conclusion, it seems that this way is doable but there will be connection time and SPI ports of our Arduino will be used.

IOIO

This project has a board already populated with I/O ports such as ADCs, PWMs and UART. This project was created to make Android phones communicate with other pieces of hardware as simple as possible. Therefore, little setup is needed to get this working. Plus, it conforms to
our architecture better since it does not use more that 2 ports of the Arduino. In fact, it adds more ports.

**PropBridge**


This project used the ADB and propeller chip to interface Android phones with the outside world. It is based on microbridge which means setup will need to be done. This setup means connections to pins of the propeller chip which seems to be more work than a USB host shield and Arduino chip.

**Microbridge - PIC**

http://code.google.com/p/microbridge-pic/

This is a port of microbridge to PIC microcontrollers. Here the downside would be the amount of work needed to get it setup. This includes hardware connections which are more than soldering a USB host shield to the ports of an Arduino.

**Google’s ADK and Arduino Mego ADK**


http://www.arduino.cc/en/Main/ArduinoBoardADK

This project uses the newly develope Android ADK and the newly developed Arduino Mega ADK. The problem with this is that it runs on Android 3.1 with back porting to Android 2.3.4. As far as I know, phones do not support these versions of Android yet. When they do, it will be limited to specific phones. This is more targetted to tablets which are to big for our robot. Besides these downfalls, this would be the best solution for us.