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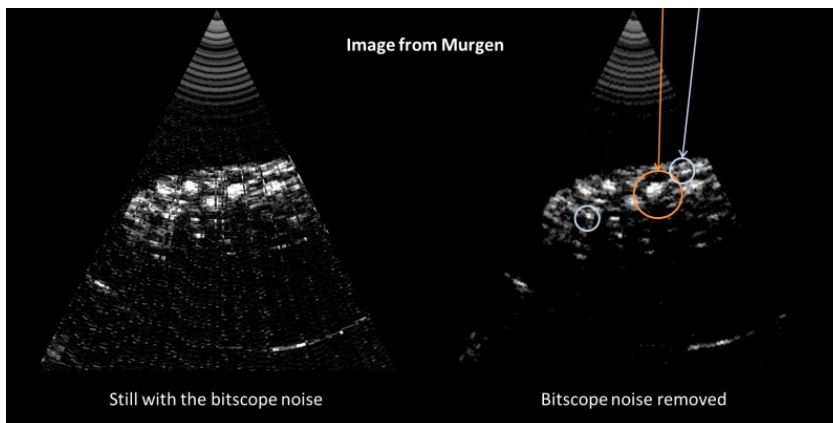
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April 18, 2016

## A DEVELOPER'S KIT FOR MEDICAL ULTRASOUND

by: [Dan Maloney](#)[22 Comments](#)

April 12, 2016



From watching a heart valve in operation to meeting your baby before she's born, ultrasound is one of the most valuable and least invasive imaging tools of modern medicine. You pay for the value, of course, with ultrasound machines that cost upwards of \$100k, and this can put them out of reach in many developing countries. Sounds like a problem for hackers to solve, and to help that happen, this 2016 Hackaday prize entry aims to create [a development kit to enable low-cost medical ultrasounds](#).

Developed as an off-shoot from the open-source [echOpen project](#), [kelu124]'s Murgén project aims to enable hackers to create an ultrasound stethoscope in the \$500 price range. A look at the test bench reveals that not much specialized equipment is needed. Other than the Murgén development board itself, everything on the test bench is standard issue stuff.



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Even the test target, an ultrasound image of which leads off this article, is pretty common stuff – a condom filled with tapioca and agar. The Murgen board itself is a cape for a BeagleBone Black, and full schematics and code are available.

We'll be paying close attention to what comes out of the ultrasound dev kit. Perhaps something as cool as [this augmented reality ultrasound scope](#)?

&nbsp;

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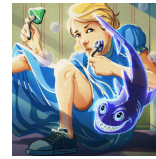
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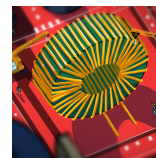
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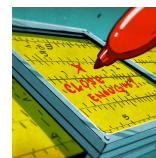
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## 22 THOUGHTS ON “A DEVELOPER’S KIT FOR MEDICAL ULTRASOUND”

**Nathan McCorkle** says:

April 12, 2016 at 10:26 pm

Ultrasound is cheaper than \$100k on aliexpress... you can get some with doppler included for \$5-10k... and without for around \$1k

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**J** says:

April 12, 2016 at 10:53 pm

You can now. But not without the carrot of r&d returns to the proprietary 100k machine no one else has guy. Take away that carrot and we stagnate developmentally. I think middle ground is 7-10yrs before removal of all

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patents/open sourced designs....for medical inventions anyway...speaking as a dr and all...

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**Me** says:

April 13, 2016 at 7:33 am

Yes. Those poor executives in those companies are just starving because all the profit goes to R&D and none is just wasted by greed.

Remind me.. when was the ultrasound machine invented? Has that R&D not been paid for yet? Oh.. so continuing R&D keeps improving it. That's great. Do you think these people are going to design something that competes with the latest and greatest out of the traditional medical technology corporations and therefore defund their R&D?

No... they are going to make something that is 'good enough' for hackers to play around with and to give Doctors in places that can't afford to buy from those companies something that is still much better than simply placing an ear to the patients' chests and guessing.

But hey.. R&D is expensive.. so.. let's just let people die.

I wonder how much kick back you get from the comanies whose drugs you sell to your patients...

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**Alex Hornstein** says:

April 12, 2016 at 11:30 pm

does that mean it's a boy?

>

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**pacraf** says:

April 13, 2016 at 3:40 am

sure it does not matter.

the only important is if it is a healthy male. Other not important. ask the Chinese if you do not believe....

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**DV82XL** says:

April 13, 2016 at 3:52 am

And that is exactly what low-cost medical ultrasounds will find a use for – sex selection in those cultures where that is a consideration.

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**When I Am Bored** says:

April 13, 2016 at 4:33 am

Yeah you're right, things shouldn't be invented or researched

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## NOW ON HACKADAY.IO

Muhammad Bilal wrote a reply on "Life is a state of mind".

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Radomir Dopieralski has added Aravind as a contributor to Robotics Chat.

cuyler wilkinson wrote a comment on [Autonomous Tractor](#).

Pulkit Aggarwal liked [Infinity Mirror Clock](#).

Radomir Dopieralski wrote a reply on [project log Abort Mission](#).

Baptiste Véré liked [Hacker Channel](#).

Muhammad Bilal has updated the project titled "Life is a state of mind".

c. jones wrote a reply on [Humanoid robot named Murphy](#).

danielmiester has added details to [ESP8266 Hot tub Controller](#).

because of some hand wavy reason that I don't like

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**Thinkerer** says:

April 13, 2016 at 5:05 am

4 posts and we're at the apocalypse – has to be a record for HAD pessimism.

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**DV82XL** says:

April 13, 2016 at 6:44 am

It was an observation, not a critique. Just as the march of technological progress cannot be held back, the ramifications of such cannot be ignored. Doing so doesn't imply that steps need be taken to "keep this out of the wrong hands," but it does mean the conversation has to be started about what the impacts will be.

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**Me** says:

April 13, 2016 at 7:36 am

Hmmm.. it can be misused. That's an interested point. Do you really think that is ALL they will use it for?

I think I might have a tumor growing inside my \_\_\_\_\_. That's ok, don't bother with the ultrasound, I'll just wait and die.

My wife is pregnant. I think it might be a girl. OMG!! Get that machine in here! quick!

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**kelu124** says:

April 13, 2016 at 5:24 am

Indeed, Thinkerer, a bit of pessimism in the air !

@J : it's also true for quite a lot of R&D! There's still a gap between a dev-kit you can play with, and a medical scanner, which also needs to be FDA(or whatever)-certified.

@Nathan, it's true for the portable echographs, even Philips has its 200\$/month ultrasound scanner you can rent. Alibaba can also provide (closed) "cheap" ultrasound machine. So these are going to be around.

It shows that there is a use for such a tool, and it's not that bad that someone takes a try at hacking it.

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**ejonecss** says:

April 13, 2016 at 6:09 am

maybe now a way for the chinese to find out the gender of the baby in their home

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**staticdet5** says:

April 13, 2016 at 7:01 am

Things that'd I'd almost kill to have in my kit: An open source EKG (FDA approved EKG systems cost a mint and aren't tiny) and an open source ultrasound. I did one deployment with a pocket doppler imaging ultrasound, and it really opened my eyes to the utility of ultrasound in austere environments. However, coming home and finding out that this piece of kit was going to be tens of thousands of dollars... Well, that killed that idea. I don't have anywhere near that kind of funding.

Good luck, mate! You need anything from someone experienced with using these things, hit me up. Big thanks for tackling this.

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**Anon** says:

April 13, 2016 at 1:03 pm

I think you'd like that project then: A portable 12-lead ECG. And it is open-source, as far as I remember.

<http://hackaday.com/2014/02/23/mobilecg-goes-open-source/>  
<http://mobilecg.hu>

Handheld ultrasound machines are around 1 – 2 K USD on Ebay. There are different types: those big boxy ones with CRTs I presume, laptop-like, slates with a handle, even those that are held on your wrist with a strap. All of them Chinese. Just search for "handheld ultrasound" or "portable ultrasound".

The problem is that none of those things above are FDA approved, but dude, there are at least some things unapproved by FDA that work. They are unlikely to harm you anyway due to their nature, the ECG is battery powered and won't be able to put enough amperes through your heart; the ultrasound is not powerful enough to pulverise your organs either.

At least I hope so. There will be nothing to choose from anyway when SHTF. Either a generic bottle of aspirin and a chinese ultrasound or death. I hate choices like that.

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**Lawson** says:

April 13, 2016 at 8:59 am

Tempted to try this with an array of X5R capacitors. I've had them squeak at me many times when a regulator goes unstable.

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**AKA the A** says:

April 13, 2016 at 10:00 am

+1 internets

Actually an interesting idea and would be a grand hack if it's proven usable.

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**K** says:

April 13, 2016 at 10:10 am

Not sure if I follow you: having the capacitor act as a piezo when submitted to an instability – and vice versa?

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**Lawson** says:

April 13, 2016 at 8:10 pm

Yup. The unstable regulators usually end up making a 1-2 volt peak to peak triangle wave. The high dielectric constant capacitor dielectrics also all tend to be piezoelectric. (afik X5R is especially piezoelectric) End result is a squealing pcb.

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**geonomad** says:

April 13, 2016 at 6:53 pm

A few years ago, I watched a paramedic who arrived at a paragliding accident in France using an ultrasound unit attached to his iPhone. It seemed so obvious. He was able to immediately check for broken bones and internal injuries before moving the patient into the helicopter. It was pretty impressive.

Googling shows at least one such product and there are probably more

<http://internetmedicine.com/iphone-smart-ultrasound/>

<https://www.google.com/search?q=iphone+ultrasound>

Who is up for making an open source Android version?

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**assdf** says:

April 15, 2016 at 6:52 am

I googled ultrasound to come up with something snarky to say. I found this image and came up with the France story because it's so much more interesting than my Mom's basement.

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**ludwig** says:

April 15, 2016 at 1:44 am

for generating the pulse: how about using the photo-acoustic effect to a dark sticker, so that acoustic coupling or impedance matching may be unnecessary? for receiving you still want piezo pressed against the skin...

with M sources (dark spots) and N detectors (piezos, or a single piezo divided into multiple like Alexander's and Dan Berards STM disc) that gives M x N independant signals...

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**Peter** says:

April 16, 2016 at 12:25 am

Hi, here in New Zealand farmers employ ultra sounding contractors to check the pregnancies of the sheep to ensure high percentage lambing rates. A friend of my owned one of these businesses. One of his employees took the equipment home and used to ultrasound his pregnant wife every night after work. The baby was born deaf and blind. This happened more than a few years ago. I felt compelled to share this when I was reading how non invasive ultrasound is.

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