



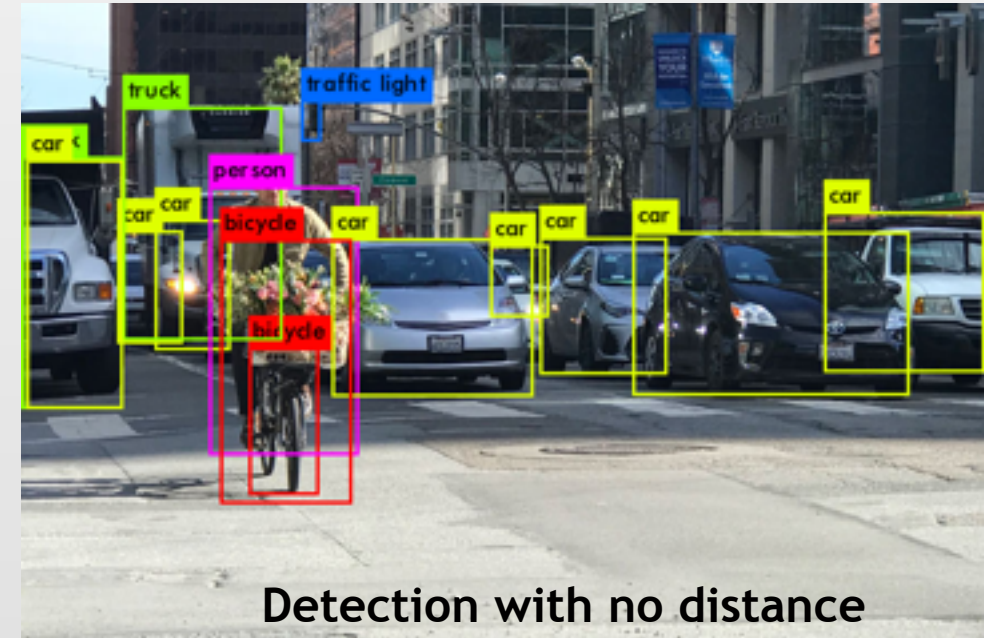
stereo vision 3D sensor

3DDeepercept

percept the world deeper with stereo vision 3D sensor

Why we develop 3D sensor

- Applications like 3D reconstruction, flying drone, ADAS, robots, vslam, etc. requires dense 3D (x,y,z) point cloud.
- traditional single camera solution is very difficult in doing this .
- 3D sensor is becoming a basic module in various intelligent systems, it is just like our human eyes, knowing the precise or rough distance of a object is crucial !

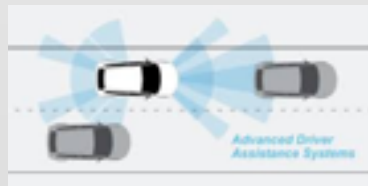


Applications & market

- flying drone, obstacle avoidance, human following, hand gesture recognition and control, etc...
- ADAS, pedestrian detection, car detection ...
- robot, navigation and collision avoidance, human following, etc...
- industrial robot-arm. locate the objects by vision.
- human-machine interaction. for instance, Kinect alike game, hand pose controlled GUI, etc..
- many many other applications where depth or 3D point cloud are required.
- the market is huge, due to the fact that more and more intelligent system needs depth info and dense point cloud.



drone



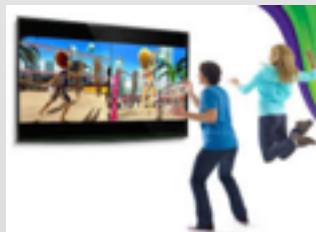
ADAS



robot



robot-arm



body-pose-sensing
game



hand pose tracking



hand controlled
VR menu

Prototype evolution, still improving

☑ Version 1.0 on GPU



☑ version 2.0 on FPGA,
higher frame rate



Types of 3D sensor, pros & cons

	stereo vision 3D sensor	structure light 3D sensor	TOF(time of flight) 3D sensor
in door	yes (structure light stereo vision 3D sensor)	yes	yes
out door under sun light	yes	no	yes
resolution at same frame rate	High (up to 1080p)	low (640 x 480)	lower
fame rate	High (60+ FPS)	low	lower
calibration between depth and colour images	No	yes	yes
cost	low	high	higher
algorithm complexity	higher	high	low
manufacture complexity	low	high	high

from the above comparison we can see that stereo vision 3D sensor is low-cost and has much wider application field, ranging from in-door to out-door, from low-end to high-end applications.

Stereo vision problems

- very heavy computational intensity
- impossible for embedded ARM processor to meet the realtime requirement.

Solutions for stereo vision, pros & cons

hardware solutions to realtime stereo vision problems are : GPU,FPGA and ASIC

	GPU	FPGA	ASIC
Power consumption	High	low	lower
design complexity	easy	hard	harder
fame rate	low	high	high
cost	high	low	very high investment and risk
time to market	faster	fast	slow

In all,FPGA solution is suitable for start-up company to open the market and ASIC validation.

Our solution

- our hardware solution is FPGA
- we have tried both GPU and FPGA solutions
- FPGA wins in both performance and power consumption in this case, and it is suitable for startups company before converting it into ASIC

Competitors



stereo vision



TOF



structure light



structure light



structure light

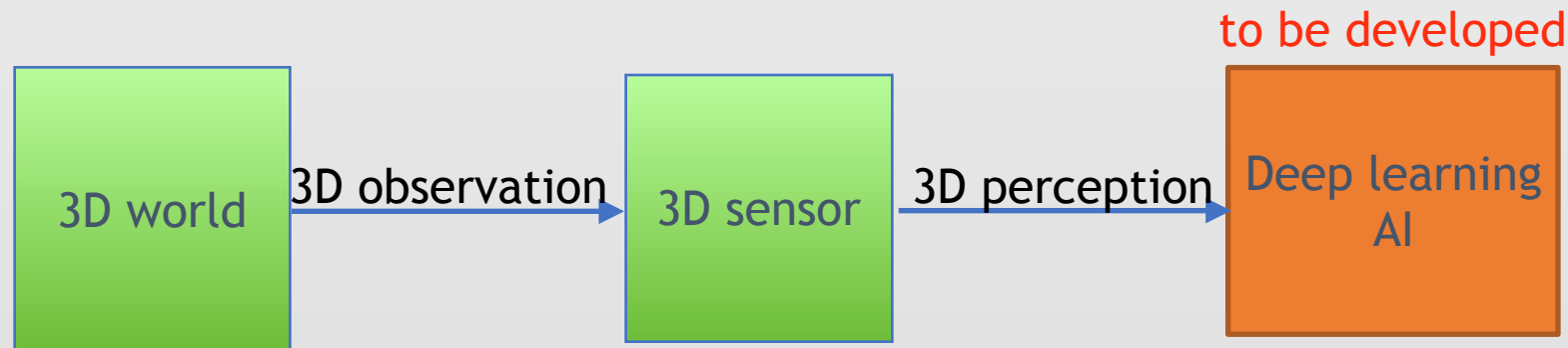
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Business model and potential volume

- selling FPGA IP,no hardware design is needed
- design our own hardware, and provide customers with 3D sensor module
- providing customers with whole application solutions based on 3D sensor
- the sales volume is huge, for instance in drone related market,each drone would require several 3D sensors. in robot-arm && laser marking machine application, with 3D sensor helping locating the 3D location of the target object,it has strong requirement to improve the productivity.

Roadmap in 1 year

- Looking for partners to sell FPGA IP, ongoing .
- For converting prototype to mass production, 3-6 month.
- For developing Deep learning object detection module, need approximately 6 months.



Team

☆ wuchenghe(Brian)

10+ years of algorithm design and large scale FPGA design experience,very rich work experience and knowledge in computer vision,machine learning and deep learning. skilled at embedded ARM linux os,device driver,and embedded app. skilled at CUDA programming, OpenGL,and android JNI.

For more please visit my linkedin webpage.

<http://www.linkedin.com/in/brianwchh/>

prototype video demos

- 3D sensor for human pose recognition, for applications like kinect game, menu remote control with bare hand gestures

<https://youtu.be/vFztyy0xzRw>



- precision test. visual ruler, measure without a physical ruler

<https://youtu.be/iO0MZLmZf58>

- realtime stereo vision demo, the depth image demo

<https://youtu.be/se1tly5UWpE>



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[AngelList-company profile](#)