UnityRobot

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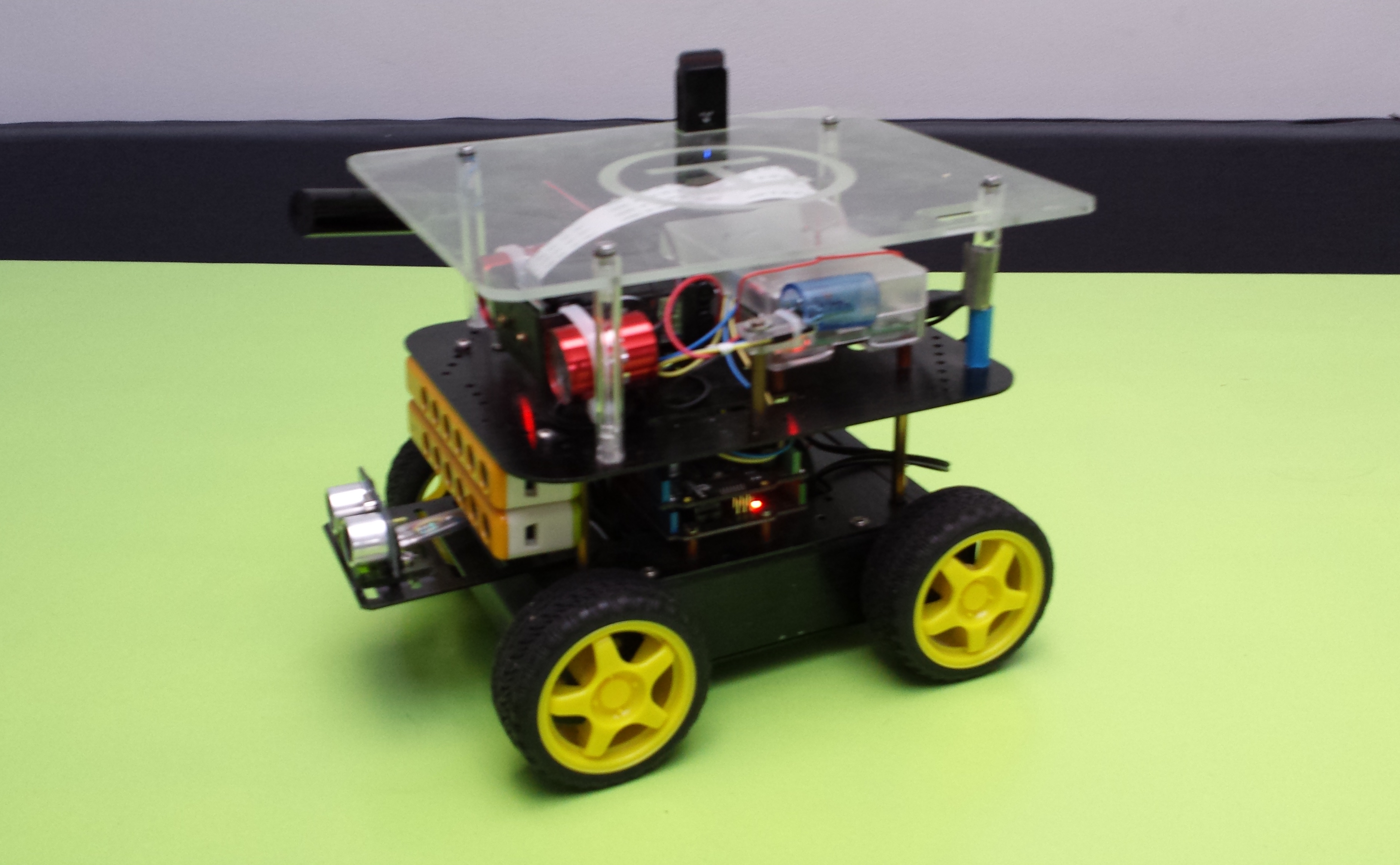


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# Introduction

In this document the work on UnityRobot is described. This can be used as base of a research document on this topic.

# Connection of Unity to EV3 Mindstorms

Connecting the EV3 Mindstorms robot is not trivial. Several options are investigated. A difficulty is that Unity 5.3.2 supports .NET 2.0. This means that existing code or libraries using .NET > 2.0 (which most do) cannot be used within Unity.  
**At the Build conference 2016 Microsoft announced that Unity will join the .NET Foundation, so in the future it will be easier to use existing code and libraries.**

## Connecting using Bluetooth and EV3Messenger

Making use of <https://ev3messenger.codeplex.com/> it is possible to connect to the EV3 using Bluetooth. However, some .NET 4 functionality is used: the queuing mechanism in System.Collections.Concurrent. So this has to be replaced. In Windows an applicstions connects to a Bluetooth device via a serial port emulation. On the Mac OS X MonoDevelop-Unity is used which does not support this, so it is not possible to use the EV3Messenger code with Unity on a Mac.

Advantage of using Bluetooth to connect to the EV3 is that mailbox messaging is supported for sending and receiving. Using Wifi, sendig to a EV3 mailbox is supported, receiving seems not to be supported.

## Connecting using Wifi and MonoBrick

Making use of <http://www.monobrick.dk/> it is possible to connect to the EV3 using Wifi. For the EV3 only the 'NETGEAR WNA1100 - N150 Wireless USB Adapter' is supported. It is tested that with MonoBrick it is indeed possible to send mailbox messages to the EV3 using Direct Commands. The MonoBrick library uses .NET 4 functionality so will not work with Unity. Receiving messages seems not to be supported. However, with Direct Commands it is possible to retrieve the sensor data. Also it is possible to read memory. It still has to be investigated whether it is possible to write the same memory from a standard EV3 program. If this is the case, it is possible to send messages to an EV3 using a mailbox and receive back messages through memory.

## Connecting using Wifi and LEGO MINDSTORMS EV3 API for .NET

Instead of MonoBrick, one can make use of <https://github.com/BrianPeek/legoev3>. These libraries also make use of .NET 4 functionality so will not work with Unity. I tested this only using a USB connection which worked.

## Connecting using Wifi and simple UDP connection

# Bibliography

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