iNEMO Engine Lite

Overview and download instructions





www.BDTIC.com/ST

iNEMO software libraries

- iNEMO software libraries, based on the Kalman filter theory applied to MEMS sensor fusion, • are divided into two categories:
 - **iNEMO Engine Lite**, a free source code software library
 - **iNEMO Engine Pro**, a compiled software library
- These engines fuse accelerometer, gyroscope and magnetometer data to deliver accurate • and reliable motion-sensing information that is easy to integrate into smart consumer devices

Both software are based on data-fusion algorithms for multiple-sensor output processing and address motion-detection applications	Part number	Description
	iNEMOEngine_LI3	iNEMO Engine Lite, platform independent, source code for STM32 and for customizable HW/SW solutions
	iNEMOEngine_PAAP	iNEMO Engine Pro, Android platform ARMEABI
This presentation focuses on iNEMO Lite	iNEMOEngine_PI3P	iNEMO Engine Pro, platform independent, for STM32
	iNEMOEngine_PW8	iNEMO Engine Pro, platform independent, for STM32 (supported by Windows 8 sensor class)



www.st.com/inemo-engine

Sensor fusion for 3D space orientation







iNEMO Engine Lite

- Based on the Kalman filter theory, ST's iNEMO Engine Lite sensor fusion software integrates readings from multiple sensors (3x gyroscopes, 6x geomagnetic modules) – it is mounted on the STEVAL-MKI062V2 iNEMO demonstration board and processed by an on-board STM32 microcontroller
- ST offers an open source version of iNEMO Lite that can be used with the STEVAL-MKI062V2 demonstration board, but can also be adapted to your own application using ST's multi-axis sensors (iNEMO inertial modules or a combination of accelerometer, gyroscope and magnetometer)





iNEMO enables new applications

 The combination of software (iNEMO Engine Lite) and hardware (STEVAL-MKI062V2 or other MEMS sensors) guarantees the high accuracy required by the most demanding applications, such as augmented reality, image stabilization, human machine interfaces, body movement recognition and robotics



Extended Kalman filter (EKF)

- Sensor fusion is implemented using an embedded extended Kalman filter (EKF) to provide • drift-free 3D space orientation running on the STM32 microcontroller
- The EKF adjusts the three sources of data (gyro, accelerometer, magnetometer) to fuse them • in the best way
- The EKF estimates the four quaternion and the three gyro biases (7-state EKF) •
- Acceleration data is used to correct roll and pitch angles, and magnetic field data improves yaw angle





iNEMO Engine Lite – key features

- Accurate motion tracking
- Reliable compass heading for accurate navigation
- 7-state extended Kalman filter
- Outputs:
 - Quaternion
 - Heading, pitch and roll
- Max ODR (EKF frequency) up to 100 Hz
- System requirements:
 - 7-Kbyte Flash memory •
 - 5-Kbyte RAM (dynamically allocated)
- Source code for STM32F103 microcontrollers



Double option for memory allocation, with or without FreeRTOS



The iNEMO demonstration board

- iNEMO Engine Lite was developed around the STEVAL-MKI062V2 demo board as the • embedded AHRS algorithm for the on-board STM32F103 microcontroller
- The library is compatible with all STM32 hardware platforms



iNEMO STEVAL-MKI062V2 demo board, combines 9-axis motion MEMS with pressure and temperature sensors and a 32-bit MCU. The system provides 3-axis sensing of linear, angular and magnetic motion, complemented with altitude and temperature readings, representing ST's 9-axis/10 degrees of freedom platform.



The Wall Street Journal **Technology Innovation** Award 2010

Computerworld Honors Program 2011 **Emerging Technology** Laureate







iNEMO Engine Lite inside Suite 2.3.0

iNEMO Engine Lite is included inside the iNEMO Suite 2.3.0* as the source code of the AHRS library - this suite includes:

- GUI (graphical user interface) for smart interaction with the board and display of sensor data
- DFU (device firmware upgrade) for firmware upgrading
- SDK (software development kit) for high communication level
- TCP/IP integrated protocol for remote connection and data streaming

SDK SDK setup **3D cube window** iNEMO[™] demo board **USB** cable GUI main window STEVAL-MKI062V2

*Suite 2.2.0 with compiled AHRS algorithm, as reference version for running projects, is still available on the STEVAL-MKI062V2 web page



www.BDTIC.com/ST

Integrated DFU

FW/SW architecture of Suite 2.3.0





Engine Lite Suite 2.3.0 and download (1/2)

In accordance with ST's policy on Trade Compliance for the use of export controlled software IPs, during the registration phase, please provide the requested information in the End Use Certification (EUC) section before submitting your download request.

> ----**Onlick** where

Click on "ASK YOUR COPY"

button available at:

www.st.com/inemo-enginelite

ABOUT ST CONTACTS PRESS LOOP

NEMOEngine_LI3 LD engine LTE - source code

parties or entities

STMinshartwaking

"I have read and I accept the Looman Ap

in accordance with the STMicroelectronics policy on Trade Compliance for the use of export controlled Software IP, please provide the following information in the End Use Certification and submit your engine like download request. If all fields are filled correctly and after successful verification, you will receive an email containing a MILOADER OR REQUESTOR 'is a mandatory field Firstname Lastname * Step 1 - Section A Full Address Fill in the requestor Country 1 Select Country Company * data, project 57 e-mail address * (corporate email is preferred) description and Office or Mobile Phone number end user fields Project description * DATA BREEF **Targeted Operating Systems** Windows 8 * 2. END USER of different from the all Firstname Lastname Address Country Select Country > Next Software download reques ne tite Software download request INEMO Engine_Lite for the use of export controlled Software is and submit your engine lite dowidoed In eccenterize with the STMicroelectronics policy on Trade Comp. For the use of expert controlled Software, the trid use Centrol and automic vour require like download mequeel. If all holds are their control with the trid use Centrol, we and automic vour require like download request. If all holds are their controlly and their accention, you will receive an email containing a accordance with the STNcroelectronics policy on Trade Compliance for the use of expert controlled Software , please provide the following information in the find use Centification and submit your engine list deveload pupel. If all fields are filled correctly and after subcessful verification, you will receive an email containing a IDECLARE TWAT IN RELATION TO THE SOFTWARE DOWNLOADED FROM STMCROELECTROMCS. DUM USE ITEMS 1.2. DESCRIPTION 1.3. GRANTITY PARTICIDATION _LCC APARTS assures cards "I copy for allight same a suppliable for describing today for up a to and up and appent according to STM-regalactionics. 2. END USE (...) clion or redistribution of the software not to accordance with this approval is expression Please, choose one or more End Users pairs, copying or reproduction of the software to any other server or location for further Augmented Reality afon is expressly prohibled, unless such reproduction or redistribution is expressi Automotive elocated to any other destination or location contrary to the repri-Computer 27 Step 2 - Section B unless with a prior written approval from STMicroelectronics. be used for ovil and-uses and will not be used in the development, production in use fit Consumer m hemical weapons, or missiles capable of delivering flese weapons. be consigned, transferred, re-exported or cold to any party or person who is known o Select the end use Factory Automation ed directly or indirectly in relation to nuclear, biological or chemical weapons, or to an Gaming :::: considement, re-agle or disposition of this software to a third party which is no segments and nature of Healticare (*) dronics is strictly prohibited without the written approval from STMic exporting & importing (original & current) countries' export control law & regulation industrial business Navigation (P) damed in this statement are true and correct to the best of our knowledge and belief and Robeben [1] acts which are inconsistent with the above statement I shall promptly update Ofield g any change of tacts or intentions set forth in this statement which may occur after the NATURE OF BUSINESS OF THE END USER TITLE OF SIGNATOR DATE 15 March 2012 Please, choose one or more End Users Commercial (** Demonstrative : e trans which I can unsubscribe at any time Anisotic (1) Othats

> Nunt

Step 3 - Declaration Read the declaration carefully, sign in with your complete name and title, read and accept the software license agreement and submit your request





Software download request INEMO Engine_Lite

Engine Lite Suite 2.3.0 and download (2/2)

After you have filled in all fields, ST will process your request, and in a few days you will receive an e-mail with a personalized download link.

If approved

From: STMicroelectronics <noreply@st-registration.com>

Subject: iNEMO Lite Registration Form

Dear Customer,

you have submitted a download request for iNEMO Lite. You request is pending approval.

The iNemo fusion engine allows you to improve the accuracy and reliability of motion-sensing information using ST's <u>accelerometers</u>, <u>gyroscopes</u> and <u>magnetometers</u>.

Thank you very much for you interest in our products.

Yours sincerely. STMicroelectronics

If rejected

Contact your local sales representative



www.BDTIC.com/ST

From: STMicroelectronics <noreply@st-registration.com>

Subject: Your iNEMO Lite download

Dear Customer,

your download request for iNemo Lite has been approved

You may download the software following this link

Please note that this link is personalized and is valid for one download only. Make sure to create a backup copy of the installation package once downloaded. When installing and before using the software you will have to accept the <u>licence agreement</u>.

Thank you very much for you interest in our products.

Yours sincerely. STMicroelectronics Before clicking on the download link, please follow these instructions:

1. Check your browser settings (disable popup-blocker, set the appropriate security and proxy settings)

2. Remember that download link is valid once only, for this reason save the zip file in your PC as first action

How to find iNEMO Engine Lite 13

After installation, Engine Lite source code is available inside the Suite 2.3.0. at: STMicroelectronics\iNEMO Suite\Firmware\iNEMO Project\iNEMO Project\iNEMO Lib\iNEMO Engine Lite

or directly from Windows Start under: Programs/STMicroelectronics/ iNEMO Suite/ Firmware/ Firmware folder



iNEMO Project\iNEMO Project\iNEMO Lib\iNEMO Engine Lite



Further information

Web pages and technical support

iNEMO Engine Lite (iNEMOEngine_LI3) SW download: http://www.st.com/inemo-enginelite

iNEMO demonstration board (STEVAL-MKI062V2): http://www.st.com/internet/evalboard/product/250367.jsp

iNEMO Inertial Modules: http://www.st.com/inemo

MEMS: http://www.st.com/mems

For technical support, click on green icon available in the product folders:

STe2eCommunities and FAQ at myST.com

iNEMO Engine Lite and STEVAL-MKI062V2 STe2eCommunities: https://my.st.com/public/STe2ecommunities/mcu/Lists/STM32F%20MEMS%20%20iNEMO/AllItems.aspx

STEVAL-MKI062V2 FAQs: https://my.st.com/public/FAQ/faq.aspx?level=3&objectid=1116&type=product

www.st.com/inemo-enginelite



or with your smartphone:







ONLINE SUPPORT