Annex


Annex 2: Datasheet of the fixed wing HP2.


Annex 4: Datasheet of the camera MicaSense RedEdge.

Annex 5: Datasheet of the multirotor DJI S900.

Annex 6: Algorithm of image processing.

Annex 7: Code to pass images from MicaSense to ODROID.
The Desert Locust situation continued to remain calm during November.

In the Central Region, adults and a few small groups moved from the summer breeding area in eastern Sudan to the Red Sea coastal plains and northeastern subcoastal areas of Sudan. Low numbers of adults were present on the coast of Eritrea and Saudi Arabia. As good rains fell along both sides of the Red Sea, small-scale breeding was already underway in Eritrea and commenced during the last week in Sudan. Local breeding also occurred along the edge of the Empty Quarter in southern Oman where good rains fell in October from Cyclone Luban. In the Western Region, small-scale breeding caused locust numbers to increase slightly in western Mauritania, northern Mali and Niger, and southern Algeria near the Niger border. Groups formed in northeast Mali and southern Algeria, and ground teams treated 130 ha in southern Algeria. A few residual summer-bred populations of solitarious adults remained in northeast Chad. During the forecast period, small-scale breeding will cause locust numbers to increase on the coastal plains along both sides of the Red Sea from southeast Egypt to central Eritrea and from northern Saudi Arabia to southwest Yemen. Small-scale breeding may also occur along the Gulf of Aden coastal plains in southern Yemen and northwest Somalia if more rains fall. Limited breeding may continue in southern Oman. Small-scale breeding is also likely to continue in Mauritania and may extend to the north of the country and to adjacent areas of Western Sahara, causing locust numbers to increase.
Ecological conditions were favourable for breeding along both sides of the Red Sea, in western Mauritania and in parts of Morocco and Algeria.

**WESTERN REGION**

Although no significant rains fell in the region during November, ecological conditions remained favourable for breeding in western Mauritania between Akjoujt and Chinguetti and in the north between Zouerate and Bir Moghrein. In Morocco, breeding conditions were favourable along the southern side of the Atlas Mountains and were improving throughout the Western Sahara. Conditions remained favourable in Algeria in the Adrar Valley and near Tamanrasset but were drying out in the extreme south along the Niger border. In the Sahel, conditions continued to dry out in all areas but remained green in a few places on the Tamesna Plains of northern Niger and near Fada in northeast Chad.

**CENTRAL REGION**

Good rains fell at times in parts of the winter breeding areas along both sides of the Red Sea in November. In Egypt, light to moderate rains fell on the coast between Marsa Alam and the Sudanese border in early November, causing flooding in some places. Consequently, breeding conditions started to improve on the coastal plains. In Sudan, breeding conditions were favourable in most coastal areas from Port Sudan to the Eritrean border as well as in subcoastal areas of the northeast in Wadi Oko/Diib where light rains fell at times. In Eritrea, light to moderate rains fell on the central and northern coastal plains and breeding conditions were favourable. In Saudi Arabia, breeding conditions were favourable in most areas along a 1,000 km stretch of coast from the Yemeni border north to beyond Yenbo. Heavy rains fell in the Jeddah area at times. Conditions were less favourable on the Red Sea and Gulf of Aden coasts of Yemen and on the northwest coastal plains in northern Somalia due to a lack of rain during November. In Oman, breeding conditions remained favourable along the edge of the Empty Quarter in the southern province of Dhofar as a result of rains from Cyclone Luban in October.

**EASTERN REGION**

No significant rains fell, and dry conditions prevailed throughout the region in November.
CHAD
• SITUATION
During November, isolated maturing and mature solitarious adults were present in the northeast near Fada (1714N/2132E) and to a lesser extent further south towards Kalait (1550N/2054E) and Arada (1501N/2040E). Copulating adults were seen at one place west of Fada on the 20th.
• FORECAST
No significant developments are likely.

SENEGAL
• SITUATION
No locust activity was reported during November.
• FORECAST
No significant developments are likely.

BENIN, BURKINA FASO, CAMEROON, CAPE VERDE, CÔTE D’IVOIRE, GAMBIA, GHANA, GUINEA, GUINEA BISSAU, LIBERIA, NIGERIA, SIERRA LEONE AND TOGO
• FORECAST
No significant developments are likely.

ALGERIA
• SITUATION
During November, small groups of solitarious and transiens hoppers of all instars, immature and mature solitarious adults, including one group, were present in the extreme south near In Guezzam (1937N/0552E) and the Niger border where breeding had occurred in October. Copulating adults were seen at one place on the 3rd. Ground teams treated 130 ha. No locusts were seen west of Tamanrasset (2250N/0528E) and in the Adrar Valley (2753N/0017W) of the Central Sahara.
• FORECAST
Low numbers of adults may persist in a few places of the extreme south.

MOROCCO
• SITUATION
During November, no locusts were seen during surveys conducted along the southern side of the Atlas Mountains and throughout Western Sahara except for isolated mature solitarious adults at one place in W. Sakia El Hamra near Haouza (2707N/1112W).
• FORECAST
Isolated adults may appear in Western Sahara and breed on a small scale if rainfall occurs. Low numbers of adults may be present in a few places south of the Atlas Mountains along W. Draa, W. Ziz-Ghris and in the northeast.

LIBYA
• SITUATION
No locust activity was reported during October. No reports were received in November.
• FORECAST
Low numbers of adults may be present and persist in areas of recent rainfall near Ghadames and Ghat. Small-scale breeding could occur if more rains fall.

TUNISIA
• SITUATION
No locust activity was reported during November.
• FORECAST
No significant developments are likely.

CENTRAL REGION
SUDAN
• SITUATION
In early November, remnants of summer-bred mature solitarious adults were present on the western side of the Red Sea Hills near Haiya (1820N/3621E) and at least one group formed southwest of Derudeb (1731N/3607E). As the month progressed, the adults moved to winter breeding areas along the Red Sea coast between Eit (2009N/3706E) and Suakin (1906N/3719E), the Tokar Delta (1827N/3741E), and the southern coast between Alerba (1753N/3819E) and the Eritrean border as well as to subcoastal areas of Wadi Oko/Dib in the northeast. Several groups of mature adults were seen copulating on the coast near Suakin while solitarious adults were laying eggs in W. Oko near Tomala (2002N/3551E), on the central coast south of Suakin and on the southern coast. Hatching commenced during the last week in Tokar Delta.
• FORECAST
Small-scale breeding will continue in Wadi Oko/Dib and along the Red Sea coast, causing locust numbers to increase.

ERITREA
• SITUATION
In early November, an increasing number of mainly isolated immature solitarious adults were detected on the central Red Sea coastal plains between Wekiero (1548N/3918E) and Mersa Gulbub (1633N/3908E) where copulating adults were seen at one place. Isolated mature solitarious adults were present further north between Mehmet (1723N/3833E) and the Sudanese border. By the end of the month, isolated third to fourth instar solitarious hoppers were present in the north and hatching had commenced in central areas near Sheib (1551N/3903E).
• FORECAST
Small-scale breeding will increase and continue on the central and northern coastal plains in areas of recent rainfall and runoff, causing locust numbers to increase slightly.

ETHIOPIA
• SITUATION
No surveys were carried out and no locusts were reported in
November.

**FORECAST**

Low numbers of adults may be present in the railway area of Dire Dawa and perhaps on the plateau near Jijiga.

**DJIBOUTI**

**SITUATION**

No surveys were carried out and no locusts were reported in November.

**FORECAST**

No significant developments are likely.

**SOMALIA**

**SITUATION**

No reports were received in November.

**FORECAST**

Small-scale breeding will occur on the northwest coastal plains if rains fall during the forecast period.

**EGYPT**

**SITUATION**

During November, isolated immature and mature solitarious adults were seen on the eastern side of Lake Nasser in the W. Allaqi (2236N/3318E) area, in subcoastal areas of the Red Sea along W. Dib and adjacent wadis, and on the coastal plains between Abu Ramad (2224N/3624E) and Shalatyn (2308N/3535E). No locusts were seen further north along the coast to Marsa Alam (2504N/3454E) or in cropping areas on the western side of Lake Nasser near Tushka (2247N/3126E) and Abu Simbel (2219N/3138E).

**FORECAST**

Small-scale breeding will cause locust numbers to increase slightly along the Red Sea coast and adjacent subcoastal areas between Shalatyn and the Sudanese border.

**SAUDI ARABIA**

**SITUATION**

During November, low numbers of immature and mature solitarious adults were present north of Mecca (2125N/3949E) and near Qunfida (1909N/4107E). No locusts were seen elsewhere along the Red Sea coastal plains between the Yemeni border and Umm Lajj (2501N/3716E).

**FORECAST**

Small-scale breeding will occur in recent areas of rainfall on the Red Sea coastal plains, causing locust numbers to increase slightly.

**YEMEN**

**SITUATION**

No reports were received in November.

**FORECAST**

Scattered locusts are almost certainly present along parts of the Red Sea coastal plains. Small-scale breeding will occur in any areas that receive rains. Scattered adults may be present in the eastern region where small-scale breeding could occur in areas that received good rains from Cyclone Luban.

**OMAN**

**SITUATION**

During November, small-scale breeding continued near the edge of the Empty Quarter in the southern province of Dhofar at Marsawdad (1914N/5421E) where scattered adults were seen copulating on the 6th. This area had received good rains from Cyclone Luban in October. No locusts were seen in the northern interior, on the Batinah coast and the Musandam Peninsula.

**FORECAST**

Small-scale breeding is likely to continue in a few areas of Dhofar and near the edge of the Empty Quarter that received good rains from Cyclone Luban.

**BAHRAIN, IRAQ, ISRAEL, JORDAN, KENYA, KUWAIT, LEBANON, PALESTINE, QATAR, SOUTH SUDAN, SYRIA, TANZANIA, TURKEY, UAE AND UGANDA**

**FORECAST**

No significant developments are likely.

**EASTERN REGION**

**IRAN**

**SITUATION**

During November, no locusts were seen on the southeast coast near Jask (2540N/5746E).

**FORECAST**

No significant developments are likely.

**PAKISTAN**

**SITUATION**

No surveys were carried out and no locusts were reported in November.

**FORECAST**

No significant developments are likely.

**INDIA**

**SITUATION**

No locusts were seen in Rajasthan and Gujarat during November.

**FORECAST**

No significant developments are likely.

**AFGHANISTAN**

**SITUATION**

No reports received.

**FORECAST**

No significant developments are likely.
Locust warning levels

A colour-coded scheme indicates the seriousness of the current Desert Locust situation: green for calm, yellow for caution, orange for threat and red for danger. The scheme is applied to the Locust Watch web page and to the monthly bulletins. The levels indicate the perceived risk or threat of current Desert Locust infestations to crops and appropriate actions are suggested for each level.

Locust reporting

Calm (green). Countries should report at least once/month and send RAMSES data with a brief interpretation.

Caution (yellow), threat (orange) and danger (red). During locust outbreaks, upsurges and plagues, RAMSES output files with a brief interpretation should be sent at least twice/week within 48 hours of the latest survey.

Bulletins. Affected countries are encouraged to prepare decadal and monthly bulletins summarizing the situation.

Reporting. All information should be sent by e-mail to the FAO/ECLO Desert Locust Information Service (eclo@fao.org). Reports received by the first two days of the new month will be included in the FAO Desert Locust Bulletin for the current month; otherwise, they will not appear until the following month. Reports should be sent even if no locusts were found or if no surveys were conducted.

Calendar

The following activities are scheduled or planned:

- **SWAC.** 31st Session, New Delhi, India (11–13 December)
- **CRC.** 31st Session, Amman, Jordan (17–21 February 2019)
- **CRC/SWAC.** 11th Interregional workshop for Desert Locust Information Officers, Addis Ababa, Ethiopia (11–15 March 2019) [tbc]
- **CRC.** 6th Regional aerial training course (March 2019) [tbc]
- **DLCC.** 41st Session (postponed to 2019)

Glossary of terms

The following special terms are used in the Desert Locust Bulletin when reporting locusts:

Non-gregarious adults and hoppers

**Isolated** (few)
- very few present and no mutual reaction occurring
- 0–1 adult/400 m foot transect (or less than 25/ha)

**Scattered** (some, low numbers)
- enough present for mutual reaction to be possible but no ground or basking groups seen
- 1–20 adults/400 m foot transect (or 25–500/ha)

**Group**
- forming ground or basking groups
- 20+ adults/400 m foot transect (or 500+/ha)

Adult swarm and hopper band sizes

**Very small**
- swarm: less than 1 km²
- band: 1–25 m²

**Small**
- swarm: 1–10 km²
- band: 25–2,500 m²

**Medium**
- swarm: 10–100 km²
- band: 2,500 m² – 10 ha

**Large**
- swarm: 100–500 km²
- band: 10–50 ha

**Very large**
- swarm: 500+ km²
- band: 50+ ha

Rainfall

**Light**
- 1–20 mm

**Moderate**
- 21–50 mm

**Heavy**
- more than 50 mm

Summer rains and breeding areas

- July–September/October
- Sahel of West Africa, Sudan, western Eritrea; Indo-Pakistan border

Winter rains and breeding areas

- October–January/February
- Red Sea and Gulf of Aden coasts; northwest Mauritania, Western Sahara

Spring rains and breeding areas

- February–June/July
- Northwest Africa, Arabian Peninsula interior, Somali plateau, Iran/Pakistan border

Other reporting terms

**Breeding**
- The process of reproduction from copulation to fledging

**Recession**
- Period without widespread and heavy infestations by swarms

**Remission**
- Period of deep recession marked by the complete absence of gregarious populations

**Outbreak**
- A marked increase in locust numbers due to concentration, multiplication and gregarisation which, unless checked, can lead to the formation of hopper bands and swarms
Upsurge
• A period following a recession marked initially by a very large increase in locust numbers and contemporaneous outbreaks followed by the production of two or more successive seasons of transient-to-gregarious breeding in complimentary seasonal breeding areas in the same or neighbouring Desert Locust regions.

Plague
• A period of one or more years of widespread and heavy infestations, the majority of which occur as bands or swarms. A major plague exists when two or more regions are affected simultaneously.

Decline
• A period characterised by breeding failure and/or successful control leading to the dissociation of swarming populations and the onset of recessions; can be regional or major.

Warning levels

Green
• Calm. No threat to crops; maintain regular surveys and monitoring.

Yellow
• Caution. Potential threat to crops; increased vigilance is required; control operations may be needed.

Orange
• Threat. Threat to crops; survey and control operations must be undertaken.

Red
• Danger. Significant threat to crops; intensive survey and control operations must be undertaken.

Regions

Western
• Locust-affected countries in West and North-West Africa: Algeria, Chad, Libya, Mali, Mauritania, Morocco, Niger, Senegal, Tunisia; during plagues only: Benin, Burkina Faso, Cameroon, Cape Verde, Côte d’Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Nigeria, Sierra Leone and Togo.

Central
• Locust-affected countries along the Red Sea: Djibouti, Egypt, Eritrea, Ethiopia, Oman, Saudi Arabia, Somalia, Sudan, Yemen; during plagues only: Bahrain, Iraq, Israel, Jordan, Kenya, Kuwait, Lebanon, Palestine, Qatar, South Sudan, Syria, Tanzania, Turkey, UAE and Uganda.

Eastern
• Locust-affected countries in South-West Asia: Afghanistan, India, Iran and Pakistan.
# Useful tools and resources

**FAO Locust Watch.** Information, maps, activities, publications, archives, FAQs, links  
http://www.fao.org/ag/locusts

**FAO Desert Locust regional commissions.** Western Region (CLCPRO), Central Region (CRC), South-West Asia (SWAC)  
http://www.fao.org/ag/locusts

**IRI RFE.** Rainfall estimates every day, decade and month  
http://iridl.ldeo.columbia.edu/maproom/\Food\Security\Locusts/index.html

**IRI Greenness maps.** Dynamic maps of green vegetation evolution every decade  
http://iridl.ldeo.columbia.edu/maproom/Food\Security/Locusts\Regional/greenness.html

**NASA WORLDVIEW.** Satellite imagery in real time  
https://worldview.earthdata.nasa.gov

**Windy.** Real time rainfall, winds and temperatures for locust migration  
http://www.windy.com

**eLocust3 training videos.** A set of 15 introductory training videos are available on YouTube  
https://www.youtube.com/playlist?list=PLf7Fc-oGpFHEdv1jAPaF02TCfpcnYoFQT

**RAMSESw4 training videos.** A set of basic training videos are available on YouTube  
https://www.youtube.com/playlist?list=PLf7Fc-oGpFHGyzXqE22j8-mPDhhGNq5So

**RAMSESw4 and eLocust3.** Installer, updates, videos, inventory and support  
https://sites.google.com/site/rv4elocust3updates/home

**FAOLocust Twitter.** The very latest updates posted as tweets  
http://www.twitter.com/faolocust

**FAOLocust Facebook.** Information exchange using social media  
http://www.facebook.com/faolocust

**FAOLocust Slideshare.** Locust presentations and photos  
http://www.slideshare.net/faolocust

**eLERT.** Online database of resources and technical specifications for locust emergencies  
http://sites.google.com/site/elertsite
# HP2-001

## Caracterización Técnica

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<th>Cuerpo</th>
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<td>Altura</td>
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## Parámetros de vuelo

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<td>Sensor</td>
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<td>Autonomía máxima</td>
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<td>Velocidad máxima</td>
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<td>Rango (distancia horizontal desde piloto)</td>
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<td>Altura máxima de vuelo</td>
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*Varía según carga de pago y la batería
**Según lo dispuesto en el Real Decreto-Ley 8/2014, art. 50
QUICK START GUIDE
The view of PIXHAWK2.1

Ports:

- GPS1/GPS2
- TELEM1/TELEM2
- I2C 2
- USB
- Analog to digital converter 3.3 V
- CAN1/CAN2
- Spektrum DSM receiver

- POWER1
- POWER2
- S.BUS
- SERIAL 5

Ground

Power

Signal
PIXHAWK2.1 and Accessories

1 PIXHAWK2.1 board with SD card
2 Buzzer
3 Safety switch
4 SD card USB adapter
5 Micro-USB cable
6 Power module
7 6-wire cable x2
8 Mounting foam

GETTING STARTED

PIXHAWK2.1 is the latest iteration of Pixhawk, which is an independent, open-hardware project. Aiming at providing high-end autopilot hardware to the academic, hobby and industrial communities at low costs and high availability! With the help of APM firmware, PIXHAWK2.1 turns any RC plane, copter, or rover into a full-featured personal drone. Once you have a fully-assembled frame, follow this guide to install PIXHAWK2.1.

I. Mount
II. Connect
III. Load firmware
IV. Calibrate
I. MOUNT

Use the provided foam or mounting screws to mount PIXHAWK2.1 as close as possible to your vehicle’s center of gravity. Make sure to orient the board with the arrow pointing forward.

For screw-method, mounting screws in PIXHAWK2.1 accessories are designed for 1.8mm thick frameboard. Customized screws are supposed to be M2.5 with thread length inside PIXHAWK2.1 in range 6mm~7.55mm.
Load SD card into the PIXHAWK2.1 Cube

If the SD card is not preloaded into Cube, insert the Micro-SD card into the slot of the Cube.
CONNECT RADIO CONTROL
For PPM RC receivers and Futaba S.Bus receivers

FOR SPEKTRUM SATELLITE RECEIVERS
For a Spektrum DSM, DSM2, or DSM-X Satellite RC receiver, connect to the SPKT/DSM port.

Connect the ground(-), power(+), and signal(S) wires to the RC pins using the provided 3-wire servo cable.
FOR PWM RECEIVERS

Purchase a PPM Encoder module to connect a PWM RC receiver to PIXHAWK2.1 at hex.aero or proficnc.com

FOR COPTERS
Connect each signal wire from the PDB to the main output signal (S) pins by motor number. Connect one wire for each motor to the corresponding pin.
Pin 1 = Motor 1
Pin 5 = Motor 5
Pin 2 = Motor 2
Pin 6 = Motor 6
Pin 3 = Motor 3
Pin 7 = Motor 7
Pin 4 = Motor 4
Pin 8 = Motor 8

FOR PLANES
For planes, connect the control channel wires to the main output signal pins.
Pin 1 = Aileron
Pin 2 = Elevator
Pin 3 = Throttle
Pin 4 = Rudder

FOR ROVERS
For rovers, connect the throttle and steering wires to the main output signal pins.
Pin 3 = Throttle
Pin 4 = Steering
III. LOAD FIRMWARE

APM firmware is the brains of your autopilot operation and must be installed before using PIXHAWK2.1. To load firmware onto PIXHAWK2.1, install a mission planner application on your ground station computer. Choose either Mission Planner (Windows) or APM Planner for (Windows, OS X, and Linux). Both applications are available for free download from ardupilot.com.

Download Mission Planner (Windows)

Ardupilot.com ➔ Downloads ➔ Mission Planner

Select latest MSI to download the most recent version.
Download APM Planner (Mac & Linux)
Ardupilot.com ➔ Downloads ➔ APM Planner 2.0

APMPlanner 2.0

Sort by: Title | Hits | Date
- APMPlanner-RPM-Latest
- APMPlanner-DMG-Latest

Select DMG for Mac and RPM for Linux.

INSTALL PLANNER

After selecting the correct file, read the safety information and select Download. Open the file to run the setup wizard. Proceed through any security warnings, and install all suggested drivers. When the installation is complete, open the application, and connect PIXHAWK2.1 to your computer using the micro-USB cable. Your computer will automatically install the correct drivers, Do not select at this time. PIXHAWK2.1 can only load firmware while unconnected to Mavlink.
Select **Initial Setup, Install Firmware**, and select your Vehicle.

When prompted, follow the directions to load the firmware. Once the status bar shows that the download is complete, power cycle the board by disconnecting and reconnecting the USB.

If you hear a musical tone, your firmware installation is complete. If you hear a series of tones followed by three beeps, disconnect the USB and reconnect while holding down the safety button. Upon restart, listen for a series of tones followed by two beeps indicating that your firmware has loaded successfully.

**IV. CALIBRATE**

With PIXHAWK2.1 connected to your computer, select the communication option from the drop-down menu for PX4 FMU, set the rate to 115200, and select the Connect icon. Select Initial Setup and Mandatory Hardware to access the calibration wizards.

---

**Remove propellers before performing calibration!**
SELECT FRAME TYPE (COPER ONLY)

Select the options to enable the compass; to allow automatic declination calculation; and to specify PIXHAWK2.1. Select Live Calibration to launch the wizard, and follow the prompts.
CALIBRATE ACCELEROMETER

Select Accel Calibration, check the box for AC 3.0+, select Calibrate, and follow the prompts to calibrate PIXHAWK2.1’s accelerometer. Make sure to wait a couple of seconds before and after changing the positions of the vehicle.

RC CALIBRATION

Select Radio Calibration to teach PIXHAWK2.1 to work with your RC transmitter. Turn on your transmitter, select Calibration Radio, and move all sticks and switches to their extreme positions. Select Clink when Done once the red bars are set for all available channels.
SELECT FLIGHT MODES

Move each switch on your transmitter to its available positions. The mission planner will indicate the currently selected position with green highlighting. Select a mode for each switch position, and select Save Modes to assign.

Calibrate ESC
Please refer to http://ardupilot.org/copter/docs/esc-calibration.html

Finish
Your flight is ready to go now!

Important Notes:
PIXHAWK2.1 integrates safety switch alone with standard GPS. If you haven’t bought the GPS. Please plug the safety switch into the GPS 1 port in order to fly.
# Specification

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<th>STM32F302</th>
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<td>Receiver Type</td>
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<td>GPS/QZSS L1 C/A, GLONASS L10F</td>
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<td>Beidou B11, Galileo E1B/C</td>
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<td>SBAS L1 C/A: WAAS, EGNOS, MSAS, GAGAN</td>
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<td>Navigation Update Rate</td>
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<tr>
<td>Time-To-First-Fix</td>
<td>Cold Start 26s</td>
</tr>
<tr>
<td></td>
<td>Aided Start 2s</td>
</tr>
<tr>
<td></td>
<td>Reacquisition 1s</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>Tracking &amp; Navigation -167dBm</td>
</tr>
<tr>
<td></td>
<td>Hot Start -148dBm</td>
</tr>
<tr>
<td></td>
<td>Cold Start -157dBm</td>
</tr>
<tr>
<td>Assisted GNSS</td>
<td>AssistNow GNSS Online</td>
</tr>
<tr>
<td></td>
<td>AssistNow GNSS Offline (up to 35 days)</td>
</tr>
<tr>
<td></td>
<td>AssistNow Autonomous (up to 6 days)</td>
</tr>
<tr>
<td></td>
<td>OMA SUPL&amp; 3GPP compliant</td>
</tr>
<tr>
<td>Oscillator</td>
<td>TCXO(NEO-M8N/Q)</td>
</tr>
<tr>
<td>RTC crystal</td>
<td>Built-in</td>
</tr>
<tr>
<td>ROM</td>
<td>Flash(NEO-M8N)</td>
</tr>
<tr>
<td>Available Antennas</td>
<td>Active Antenna &amp; Passive Antenna</td>
</tr>
<tr>
<td>Signal Integrity</td>
<td>Signature feature with SHA 256</td>
</tr>
</tbody>
</table>

## Protocols & Interfaces

- UART/ I2C/ CAN: JST_GH
- STM32 Main Programming Interface: JST_SUR

## Operating Condition

- Operating Temperature: -40°C to 85°C

## Dimension & Weight

- Dimension: 76mmx76mmx16.6mm
- Weight: 49g
Multispectral sensing for any platform

MicaSense RedEdge™ is an advanced multispectral camera specially designed for small unmanned aircraft systems. It provides accurate multiband data for agricultural remote sensing.

RedEdge™ is powered by MicaSense, Inc., a team of data-collection leaders with decades of expertise in a variety of unmanned aerial vehicle (UAV) applications. MicaSense is redefining remote sensing technology and pioneering a new way to harvest information.

Key Features

- Simultaneous capture of five discrete spectral bands
- Narrowband optical filters provide full imager resolution for each band
- Fast capture rate enables faster flight speeds and lower flight altitudes
- Global shutter design for distortion-free results on every platform
- Single SD card stores all images with geotags
- Calibrated for precise, repeatable measurements
- Rugged design with no moving parts
- Standalone operation, with optional external trigger and data from host aircraft
- Intuitive web-based interface accessed from any Wi-Fi capable device
- Option for Ethernet or serial connectivity with host aircraft for full configuration, status, and control of the camera
**Spectral bands**
High-grade optical filters deliver precise information specially targeted to agricultural applications.

![Spectral bands graph](image)

**Detailed, quantitative information maps**
This data map shows a vineyard from 400 feet above ground level (AGL). Zooming in offers information on individual plant vigor.

![Detailed maps](image)

*Normalized Difference Vegetation Index

**Specifications**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>150 g (5.3 oz)</td>
</tr>
<tr>
<td>Dimensions</td>
<td>12.1 cm x 6.6 cm x 4.6 cm (4.8 in x 2.6 in x 1.8 in)</td>
</tr>
<tr>
<td>External Power</td>
<td>5.0 V DC, 4 W nominal</td>
</tr>
<tr>
<td>Spectral Bands</td>
<td>Blue, green, red, red edge, near IR (narrowband)</td>
</tr>
<tr>
<td>Ground Sample Distance</td>
<td>8 cm per pixel (per band) at 120 m (~400 ft) AGL</td>
</tr>
<tr>
<td>Capture Rate</td>
<td>1 capture per second (all bands), 12-bit RAW</td>
</tr>
<tr>
<td>Interface</td>
<td>Serial, Ethernet, GPS</td>
</tr>
<tr>
<td>Field of View</td>
<td>47.2 º HFOV</td>
</tr>
</tbody>
</table>

RedEdge™ generates standards-compliant images that can be used with the MicaSense ATLAS data processing solution, as well as a variety of orthomosaic-creation and mapping tools.

**Fly Your Mission**

**Upload Your Raw Data Securely**

**Accurate Crop-Health Maps Created**

**View and Manage Your Data from Anywhere**
## HAR8

### Caracterización Técnica

#### Cuerpo
- Envergadura: 900 mm
- Longitud de brazo: 358 mm
- Diámetro del cuerpo central: 272 mm
- Tamaño del tren de aterrizaje: 305 (L) x 460 (W) mm

#### Motores
- Dimensiones del estator: 41 x 14 mm
- kV: 310 rpm/V
- Peso: 205 g

#### ESC
- Intensidad de trabajo: 40 A
- Voltaje de trabajo: 6S Lipo
- Peso: 35 g

#### Parámetros de vuelo
- Tipo de vuelo: Radiocontrol
- Operación: Agricultura de precisión
- Sensor: Micasense RedEdge
- Control de camera: Movimiento en dos ejes
- Peso máximo de la carga de pago (MPL): 1 Kg
- Peso máximo al despegue (MTOW): 8,2 Kg
- Capacidad de la batería: 16000 mAh (6S)
- Consumo máximo: 3000 W (500 W/motor)
- Autonomía (hovering time): 20 min*
- Velocidad de crucero: 35 km/h
- Velocidad máxima: 60 km/h
- Rango (distancia horizontal desde piloto): 500 m **
- Altura de vuelo: 120 m **
- Temperatura de trabajo: -10 → 45 ºC

* Varía según carga de pago
** Según lo dispuesto en el Real Decreto-Ley 8/2014, art. 50
import exifread
import os
import time
from PIL import Image

tiempoIn=time.time()
filename = os.listdir("/Users/guillemarmengol/Desktop/imagenesin/")

while True:
    length1 = len(filename)
    filename2 = os.listdir("/Users/guillemarmengol/Desktop/imagenesin/")
    filename2.sort()
    length2 = len(filename2)
    if length2 > length1 +1:
        last=len(filename2)
        rutavermelha="/Users/guillemarmengol/Desktop/imagenesin/" + filename2[1]
        im11=Image.open(rutavermelha)
        rutanir="/Users/guillemarmengol/Desktop/imagenesin/" + filename2[2]
        im22=Image.open(rutanir)
        imv= im11.crop((25,0,1280,945))
        imn= im22.crop((0,15,1255,960))
        ren,col = imv.size
        i=0
        b=0
        n=0
        while i < imv.size[0]:
            j=0
            while j < imv.size[1]:
                valorvv=imv.getpixel((i,j))
                valorv=(valorvv-4096)/61424
                valornn=imn.getpixel((i,j))
                valorn=(valornn-4096)/61424
                valorsuma= valorn + valorv
                valorresta= valorn - valorv
                valordiv= valorresta/valorsuma
                if valordiv >=0.2:
                    b=b+1
                else:
                    n=n+1
                j+=1
            i+=1
        percent= (b*100)/(b+n)
        print(percent)
if percent>=5:
    l1=[]
    llista=[]
f=open(rutavermella,'rb')
tags=exifread.process_file(f)
for a in tags:
    if a == "GPS GPSLatitude":
        s=tags.get("GPS GPSLatitude")
        s1=str(s)
        s2=s1[1:-1].split(',')
        l1.append(s2)
    elif a == "GPS GPSLongitude":
        s=tags.get("GPS GPSLongitude")
        s1=str(s)
        s2=s1[1:-1].split(',')
        l1.append(s2)
    elif a == "GPS GPSLatitudeRef":
        s=tags.get("GPS GPSLatitudeRef")
        nord=str(s)
    elif a == "GPS GPSSLongitudeRef":
        s=tags.get("GPS GPSSLongitudeRef")
        est=str(s)
    for s in l1:
        d=[]
        for elem in s:
            if "/" not in elem:
                elem=float(elem)
                d.append(elem)
            else:
                f=elem.split('/'
                g=float(f[0])/float(f[1])
                d.append(g)
        llista.append(d)
lat=llista[0]
d=lat[0]
m=lat[1]
s=lat[2]
latitud= d+(m / 60.0) + (s / 3600.0)
long=llista[1]
dd=long[0]
mm=long[1]
ss=long[2]
longitud= dd+(mm / 60.0) + (ss / 3600.0)

if nord != "N":
latitud = 0 - latitud
if est != "E":
    longitud = 0 - longitud
coord=latitud,longitud
#print(coord)
arxiu=open("coord.txt", "a")
arxiu.write(str(coord)+"\n")
arxiu.close()
    os.remove("/Users/guillemarmengol/Desktop/imagenesin/"+filename2[2])
    os.remove("/Users/guillemarmengol/Desktop/imagenesin/"+filename2[1])
else:
    os.remove("/Users/guillemarmengol/Desktop/imagenesin/"+filename2[2])
    os.remove("/Users/guillemarmengol/Desktop/imagenesin/"+filename2[1])
tiempoFin=time.time()
import requests
import time
from datetime import datetime
import os
from natsort import natsorted

def main():
    while(True):
        r = wait_for_camera()
        rededge_file_transfer(r)

    # This method is the core of the program, containing the main loop which grabs
    # files from the camera
    def rededge_file_transfer(r):
        folder_index = []
        subfolder_count = 0
        try:
            print r.json()
            for n in range(0,len(r.json()]['directories'])):
                folder_index.append(r.json()['directories'][n])
            print 'Unsorted: %s' % folder_index
            folder_index = natsorted(folder_index)
            print 'Sorted: %s' % folder_index
            while(len(folder_index) > 2):
                grab_everything_in_dir(folder_index[0])
                folder_index.pop(0)

        new_dir(path + folder_index[0])
        new_dir(path + folder_index[0] + '/%03d' % subfolder_count)
        startTime = datetime.now()

        while(True):
            tdelta = datetime.now() - startTime
            r = requests.get(host + 'files/%s/%03d' % (folder_index[0], subfolder_count),
                              timeout=1)
            print folder_index
            print r.json()
            # If the user has turned on the camera but taken no captures, wait
            if("Invalid file path" in r.text):
                print "Waiting for valid file path"
                time.sleep(1)
                continue
            # Check for image buffer
            if(len(r.json()['files']) > 10):
                get_captures(r, folder_index[0], subfolder_count)
                startTime = datetime.now()
            else:
# Grab remaining captures
if (tdelta.total_seconds() >= 30):
    while (len(r.json()['files']) is not 0):
        print "Captures left in folder: %s" % str(len(r.json()['files']))
        get_captures(r, folder_index[0], subfolder_count)
        r = requests.get(host + "files/%s/%03d" % (folder_index[0],
          subfolder_count), timeout=1)
        s = requests.get(host + "files/%s" % folder_index[0], timeout=1)
        # Check for multiple folders in the ####SET folder
        if (len(s.json()['directories']) > (subfolder_count + 1)):
            subfolder_count += 1
            new_dir(path + folder_index[0] + "/%03d" % subfolder_count)
            startTime = datetime.now()
else:
    time.sleep(1)
    continue
except:
    # Wait for camera to respond if any error is encountered
    return

def wait_for_camera():
    while (True):
        try:
            r = requests.get(host + "files", timeout=1)
            return r
        except requests.exceptions.RequestException:
            print 'Waiting for camera response'

def get_captures(files, folder_index, subfolder_count, k=5):
    for n in range(0,k):
        r = requests.get(host + "files/%s/%03d/%s" % (folder_index, subfolder_count,
          files.json()['files'][n]['name']), stream=True)
        print files.json()['files'][n]['name']
        with open(path + '%s/%03d/%s' % (folder_index,
          subfolder_count, files.json()['files'][n]['name']), 'wb') as f:
            for chunk in r.iter_content(10240):
                f.write(chunk)
        r = requests.get(host + "deletefile/%s/%03d/%s" % (folder_index,
          subfolder_count, files.json()['files'][n]['name']))

def get_logs(files, folder_index):
    print 'Grabbing diag & paramlog'
    for n in range(0,2):
        r = requests.get(host + "files/%s/%s" % (folder_index,
          files.json()['files'][n]['name']), stream=True)
        print files.json()['files'][n]['name']
with open(path + "%s/%s" % (folder_index, files.json()['files'][n]['name']), 'wb') as f:
    for chunk in r.iter_content(10240):
        f.write(chunk)
    r = requests.get(host + "deletefile/%s/%s" % (folder_index, files.json()['files'][n]['name']))

def new_dir(path):
    if not os.path.exists(path):
        os.mkdir(path)

def grab_everything_in_dir(folder_index):
    new_dir(path + folder_index)
    r = requests.get(host + 'files/%s' % folder_index)
    print r.json()
    print len(r.json()['directories'])
    if(len(r.json()['directories']) is not 0):
        for n in range(0, len(r.json()['directories'])):
            new_dir(path + folder_index + "/%03d" % n)
            time.sleep(0.5)
            s = requests.get(host + 'files/%s/%s' % (folder_index, r.json()['directories'][n]['name']))
            if(len(s.json()['files']) is not 0):
                get_captures(s, folder_index, n, len(s.json()['files']))
            else:
                pass
    else:
        pass
else:
    pass
if (len(r.json()['files']) is not 0):
    get_logs(r, folder_index)
else:
    pass

if __name__ == '__main__':
    main()