ARIEL UNIVERSITY / Department of Computer Science and Mathematics

MOBILAB

Abstract:

During the process of investigating helpful technologies to autonomous vehicles, we found that there is a real need in a standalone system that hold the ability to gather and process real-time information and telemetry that connected to it, such as: Camera, Microphone, Barometer, GPS Location, Temperature, etc…

The ability to process this information and send it to the ground-station in real-time, parallelly to send this information to a connected cloud services and of course store this information and data locally on the device storage, grant the autonomous vehicle technology and specifically UAV's new strong and important abilities.

Such technology can get the market to developing new autonomous vehicles with new abilities that never seen up for today, also improvement of existing systems on existing autonomous vehicles that are not carrying mobile lab systems such as describe above.

The MobiLAB application designed to include two separated components, the former will be the system Application for an Android devices which will give the user controlling abilities on recording the sensors and change the settings.
And the latter will be an Android background Service which will run on the background of the mobile device and will be the authority to record data from the sensors, gather important information, analyze it, send the data to the ground and cloud control stations.

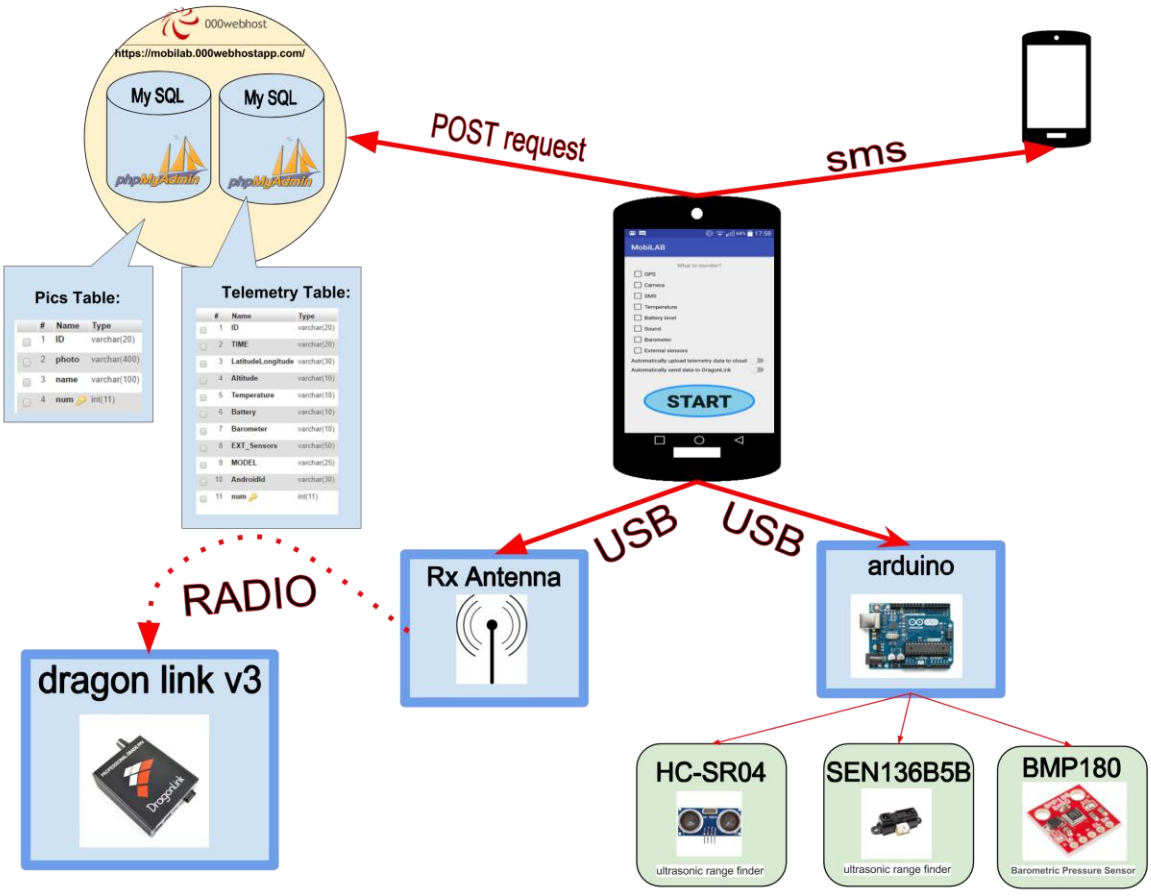
The Android device planned to be as small as possible and the application won't demand from it high computing performance of a new Android devices (Android SDK 4.4.3 version or newer), to keep things and weight as simple and light as possible.

As we said the device will communicate with the user on several channels of communication such as:

- **SMS messages** which will contain critical information about the system state such as GPS location, battery level and temperature, also they will be encoded in order to save bandwidth.
- **4/3G connectivity** to the cloud that was pre-configured in order to real-time backup all the gathered information.
- **UHF Transceiver** (DragonLink) that send and receive all the data and telemetric information from the device into the ground station.
- **Local Storage** save all of the information which will be encrypted to avoid unwanted elements to access the data and also save storage space on the disk.

Mobilab architecture

BackEnd



Define the need:

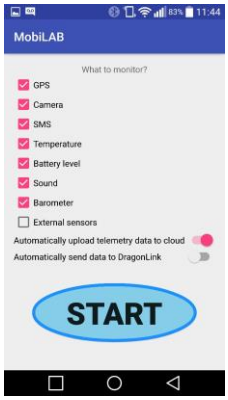
develop android system that makes the android device to “mobile lab”.
The system will be useful to scientific experience or just for people who wants to get information from their remote device.

Use cases:

- The app will use all the relevant sensors that exist on the device (GPS, Temperature, Atmospheric Pressure, Sound, etc…). ability to connect external sensors (via the auxiliary or the mini USB OTG).
- Communicating with the data to database.
- Sending SMS’s with the relevant data to the ground station.
- Every user will have separately web Dashboard database.
- The app could get orders from other devices (with SMS for example).
- The application is guaranteed to be efficient and battery friendly and totally secured.

Sign in & Authentication:

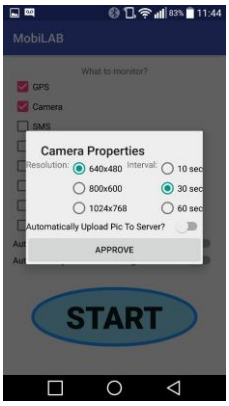
Right with the launch of the application the user will prompt to an authentication screen to fill in google username and password account.



Main Screen View:

After the user has logged into the application the main menu screen will appear and will have the following check boxes options:

- GPS
- Camera
- SMS
- Temperature
- Battery level
- Sound
- Barometer Pressure
- External sensors
- Upload data to cloud
- Using the UHF (DragonLink) ability



Launching the service:

After pressing the “START” button a service with several threads will launch and start monitoring the environment until the back key will pressed by the user.

Remote SMS control - TBA:

Controlling the application will be available remotely from another device by using SMS messages using the preconfigured template and commands. The string that will be received on the ‘lab’, will be phrased and will execute the wanted commands remotely.

SMS critical data monitoring:

Critical data about the system such as GPS location and battery level will be sent to the preconfigured number that was entered by the user.

Backend access to Database:

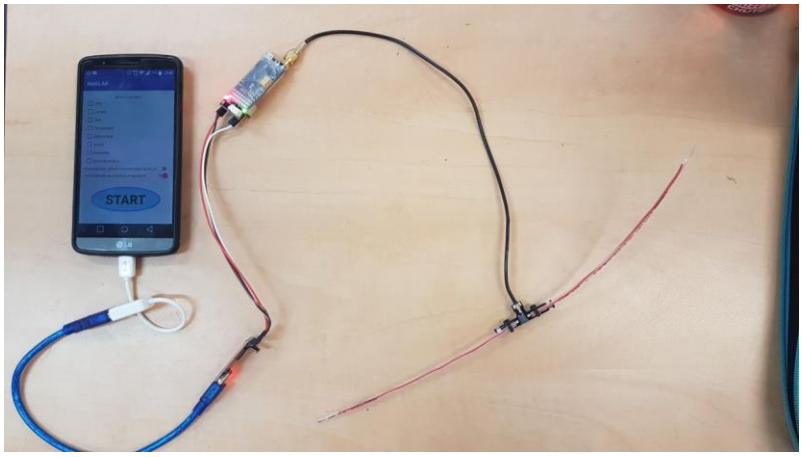
The app will be synced with the preconfigured private cloud and will upload the recorded information directly to it, whenever the signal affords it.

Frontend access to Database:

ARIEL UNIVERSITY / Department of Computer Science and Mathematics

Every user will have a private web real-time updated dashboard that will show a graphic user interface with all of the data that received from the MobiLAB application.

UHF communication (DragonLink):



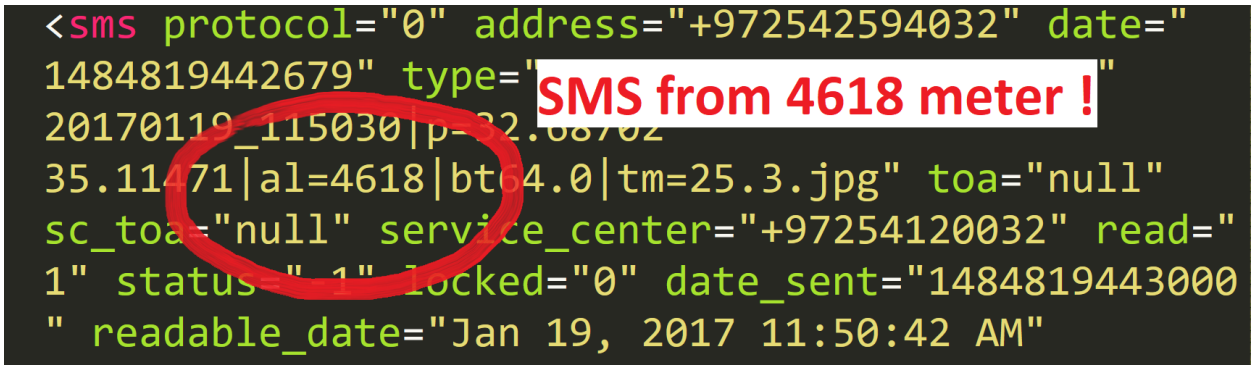
Application design:

Login Activity	Main Menu Activity	Main Activity
Sign in screen	main menu screen	application working screen
username	list of sensors:	gps location parameters
password	gps	camera preview box
connect button	camera	using the CameraPreview Object
create new account	sms	using the USBService Object
	temperature	relevant threads from main menu invoked
	battery level	
	sound	
	barometer	
	external sensors	
	launch service button	

Experiments:

19.1.16 Haifa bay balloon blow –

In this experiment, we used an Israeli SIM card, and communicate through 3G communication.
We managed to receive photos from maximum altitude of ~4700.



YouTube Video

6.2.17 Mizpe Ramon bay balloon blow –

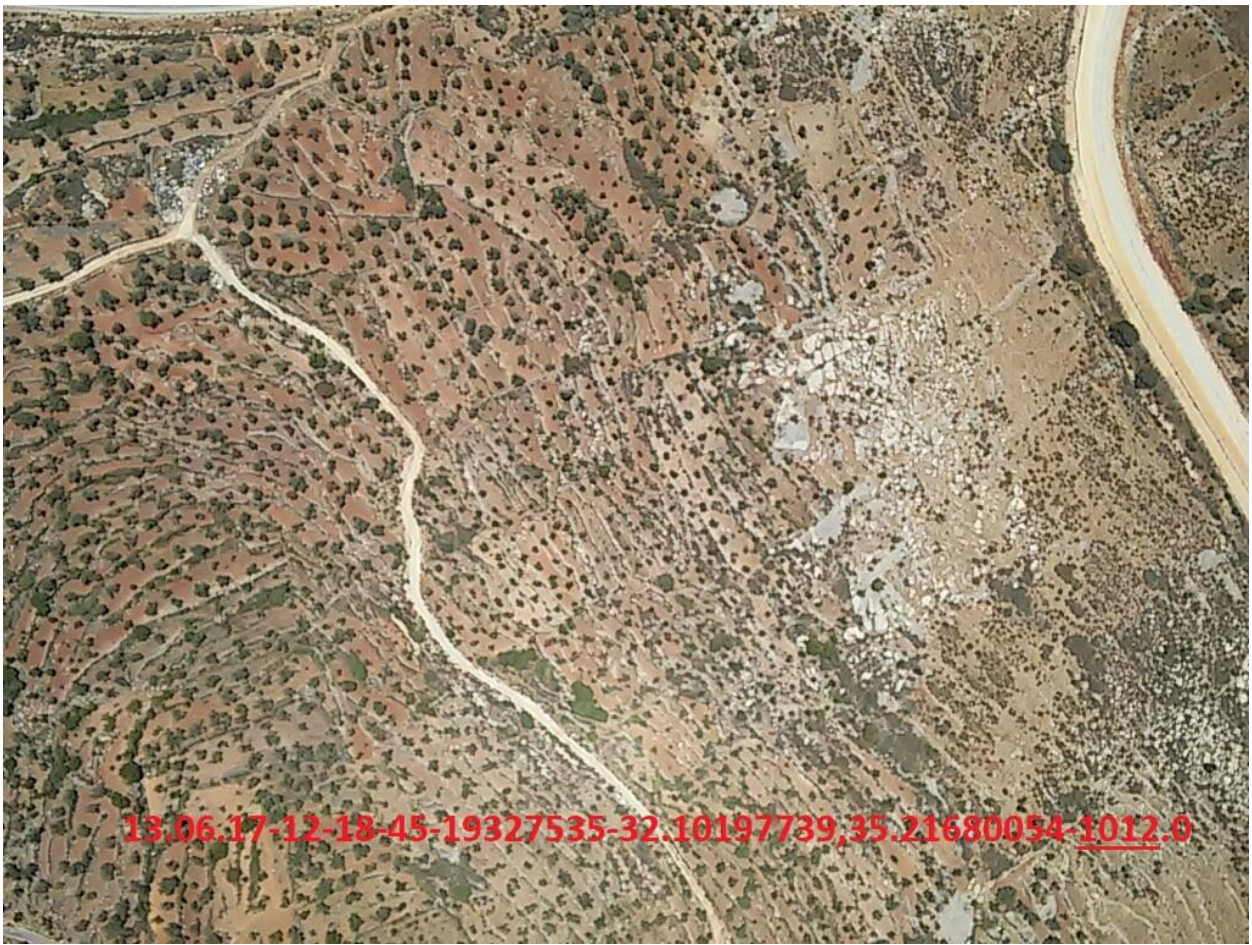
6.6.17 Ariel bay balloon blow –

In this experience we failed, we used Jordan SIM card, we had problem, all the pictures were white and all the telemetry was the same…

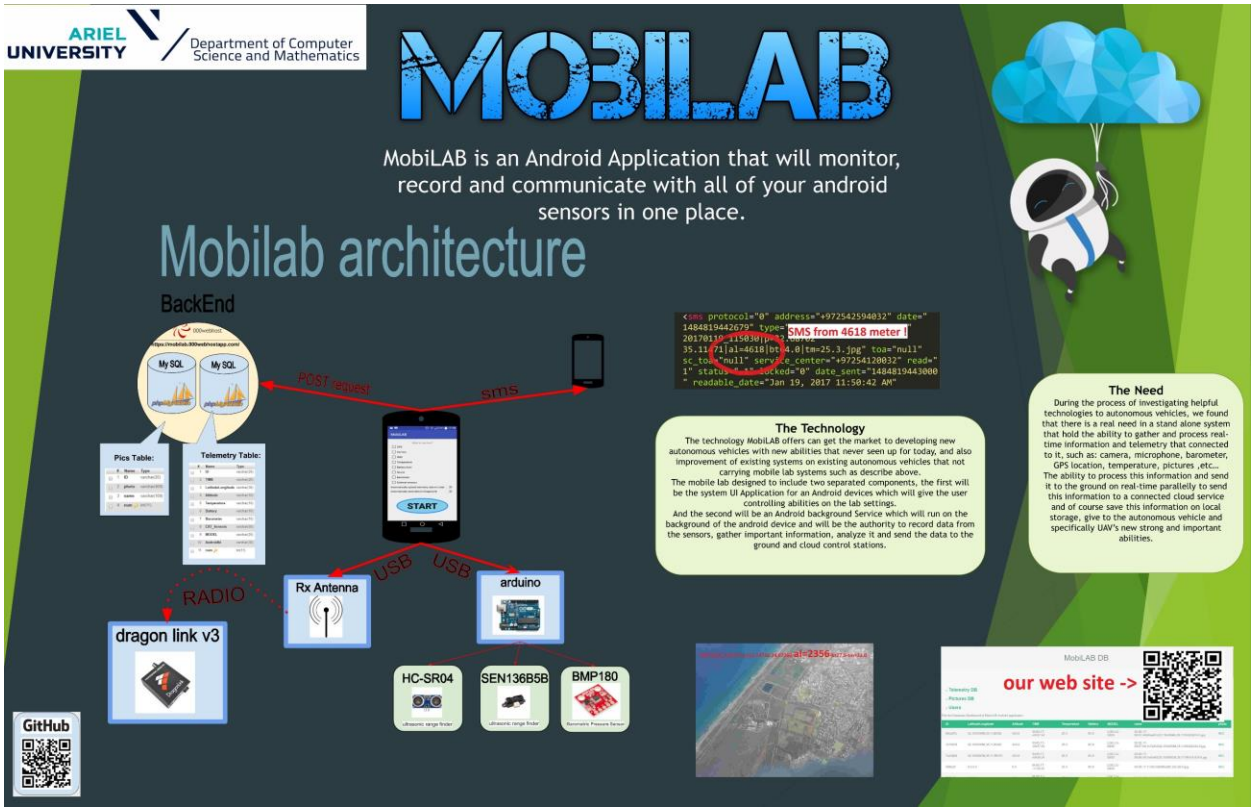
19.1.16 Ariel university balloon blow – we used with long WiFI signal to process the data, we got full telemetry until 1658 meter (1 kilometer rang):

ID	TIME	LatitudeLongitude	Altitude	Temperature	Battery	Barometer	EXT_Sensors	MODEL	AndroidId	num
101763630	13.06.17--12:21:53	32.09726646,35.22614143	1506.0	52.6	93.0	-1.0	0.0	LGE LG-D722	355403064309245	126544
40170488	13.06.17--12:22:03	32.09634229,35.22731127	1567.0	52.6	93.0	-1.0	0.0	LGE LG-D722	355403064309245	126545
58873232	13.06.17--12:22:13	32.09634229,35.22731127	1567.0	52.6	93.0	-1.0	0.0	LGE LG-D722	355403064309245	126546
34148608	13.06.17--12:22:23	32.09526765,35.22843129	1629.0	52.6	93.0	-1.0	0.0	LGE LG-D722	355403064309245	126547
43092854	13.06.17--12:22:33	32.09482621,35.22899521	1658.0	52.6	93.0	-1.0	0.0	LGE LG-D722	355403064309245	126548
43092854	13.06.17--12:22:33	32.09482621,35.22899521	1658.0	52.6	93.0	-1.0	0.0	LGE LG-D722	355403064309245	126549


13.06.17-12-18-14-82060841-32.10221023,35.2159649-942.0


13.06.17-12-18-45-19327535-32.10197739,35.21680054-1012.0


13.06.17-12-19-15-65933919-32.10145212,35.21763985-1096.0


ARIEL UNIVERSITY
Department of Computer Science and Mathematics
MOBILAB
MobiLAB is an Android Application that will monitor, record and communicate with all of your android sensors in one place.
Mobilab architecture
BackEnd
My SQL
My SQL
POST request
sms
Pics Table:
Telemetry Table:
START
USB
USB
RADIO
Rx Antenna
arduino
dragon link v3
HC-SR04
SEN136B5B
BMP180
GitHub
SMS from 4618 meter !
The Technology
The technology MobiLAB offers can get the market to developing new autonomous vehicles with new abilities that never seen up for today, and also improvement of existing systems on existing autonomous vehicles that not carrying mobile lab systems such as describe above.
The mobile lab designed to include two separated components, the first will be the system UI Application for an Android devices which will give the user controlling abilities on the lab settings.
And the second will be an Android background Service which will run on the background of the android device and will be the authority to record data from the sensors, gather important information, analyze it and send the data to the ground and cloud control stations.
The Need
During the process of investigating helpful technologies to autonomous vehicles, we found that there is a real need in a stand alone system that hold the ability to gather and process real-time information and telemetry that connected to it, such as: camera, microphone, barometer, GPS location, temperature, pictures ,etc...
The ability to process this information and send it to the ground on real-time parallelly to send this information to a connected cloud service and of course save this information on local storage, give to the autonomous vehicle and specifically UAV's new strong and important abilities.
MobiLAB DB
our web site ->