



Fig1. First MicroStage prototypes and their smartphone app.

# MicroStage MOTORIZED MICROSCOPE STAGE FOR SMARTPHONE

MicroStage project is being developed in the scope of the Information and Communication Technologies for Development Competence Center (ICT4DCC) project MalariaScope. It aims to create a mobile and autonomous solution for Malaria detection in human blood, to be used by laypersons without medical skills in developing countries.

### Motivation

According to World Health Organization, Malaria is the second leading cause of death in the African continent. One of the main reasons for this fact is the time that it takes to get a result from a blood analysis. This period of time severely limits what any doctor can do in order to try to cure the patient, often leading to fatal results due to the late administration of an appropriate drug. Resulting of this, there is an urgent need of new tools that can facilitate the diagnosis.

The initial MalariaScope prototype (developed within Fraunhofer AICOS) already featured an autonomous image analysis but needed manual adjustment of the blood smear. This procedure went against the general goal of creating a fully autonomous solution. MicroStage project was born out of this need.

## Description

MicroStage main idea is to build a motorized XY stage driven by a smartphone with piezoelectric (PZT) or electrical motors as cheap as possible and capable of being replicated easily

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#### Actuators Used

To move the stages, two types of actuators were used, one type per implementation:

- Piezoelectric benders consume little power, have very precise movement and low price;
- DC motors very cheap, easy to use and average power consumption.

#### **Project Status**

The project started as a master's thesis in middle of February of 2014.

At the end of the thesis, two prototypes were presented. They are still proofs of concept and one of them will be made final and integrated in the MalariaScope prototype up to the end of the year 2014.



Fig2. Block diagram. All blocks in blue are a subject of the MicroStage.

in third world countries. Its block diagram can be observed in figure 2.

### Main Results

This thesis project led to two different prototypes.

The prototype based in PZT actuators uses an Arduino based board to control a DC-DC converter that drives the actuators at 50V from the Smartphone's 5V USB OTG connection. The Arduino is fully controlled by an Android Smartphone using a simple library and application (figure 3) developed for this ecosystem. The mechanical principle used is based in the stick-slip phenomenon. This possible solution still needs some work but the preliminary results gave an approximate step size of 250µm and an autonomy time around 5h30.

The prototype based in DC motors uses the same Arduino controller board and library but uses an H-bridge circuit to control the motor direction. It uses old cd-drives based in gears to provide the movement but it will be replaced by a custom made system in the future. This possible solution presents an approximate step size of  $300\mu m$  and an autonomy time around 6h50.

# Android App

The app developed can fully control the table or each motor by itself. It is powered by the MicroStage library that is built over the USB Serial for Android open source library. It is very raw because it will be fully integrated in the MalariaScope existing software.



Fig3. Screenshot of the MicroStage main controller Android app.