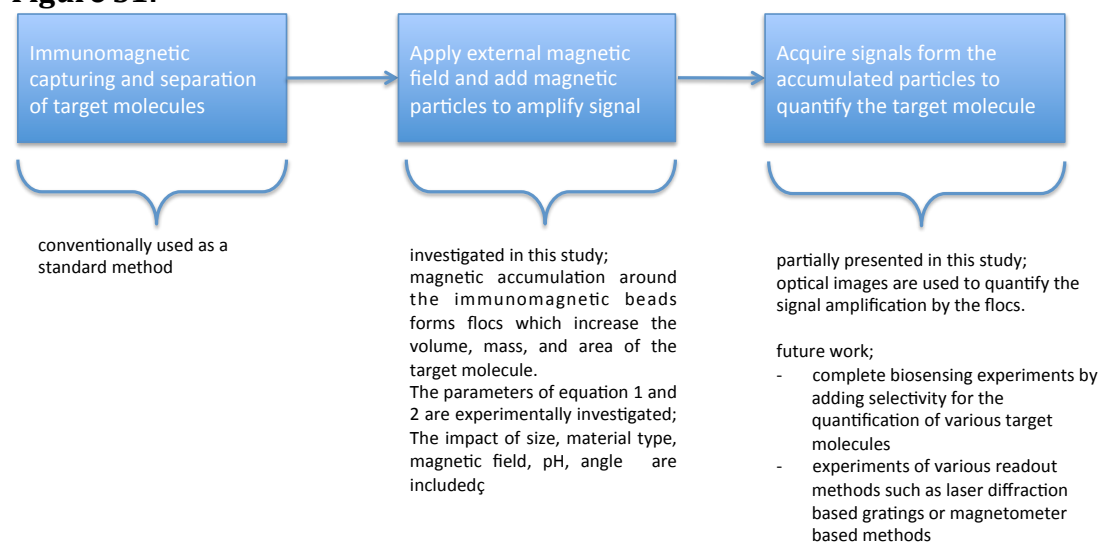


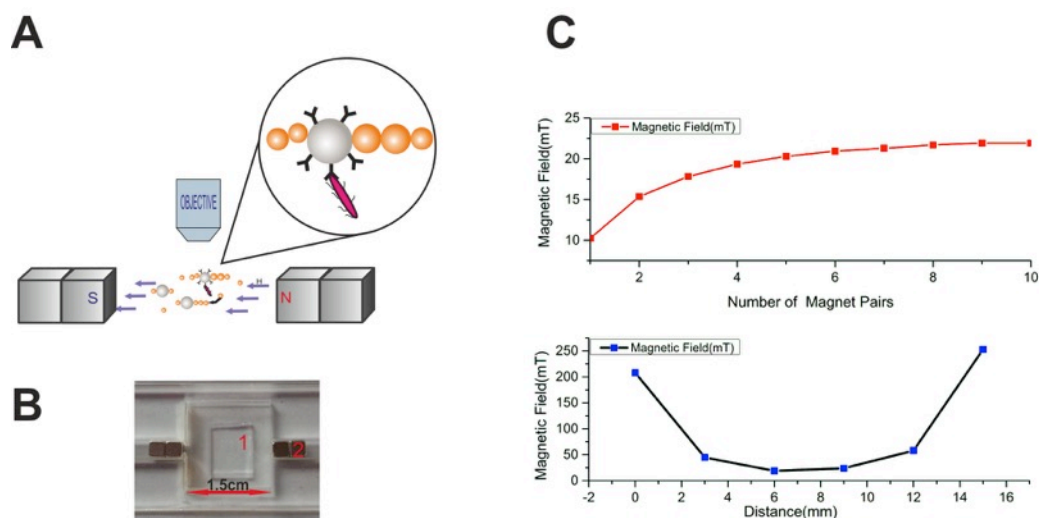
Supplementary Material

Figure S1:



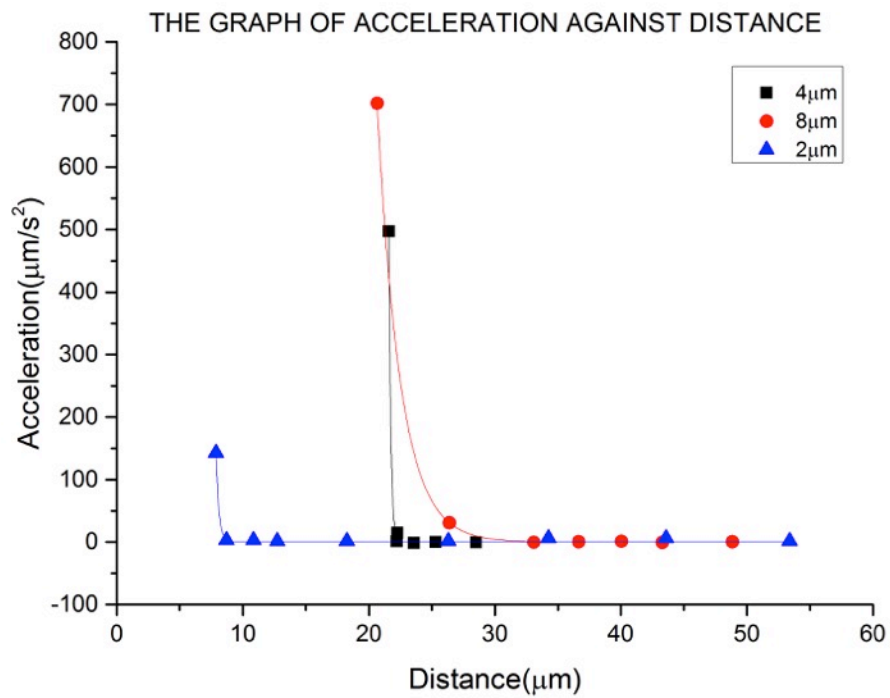
Flow diagram showing the main experimental steps of the proposed method

Figure S2:



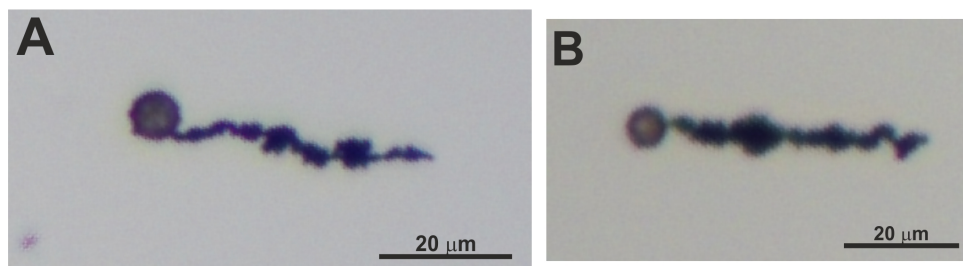
(A) Illustration of magnetic accumulation based sensing system; base beads together with the attached beads inside the magnetic field. **(B)** The magnet platform with two magnets each side, glass pieces placed in the middle between permanent magnets. 1 is the glass microscope slide piece, 2 are magnet cubes. **(C top)** Variation of the magnetic field at the middle point of the magnetic platform when number of magnet pairs increased. **(C bottom)** Variation of the magnetic field between two magnet pairs. The measurement was performed on different points towards and away from the center of the platform.

Figure S3:



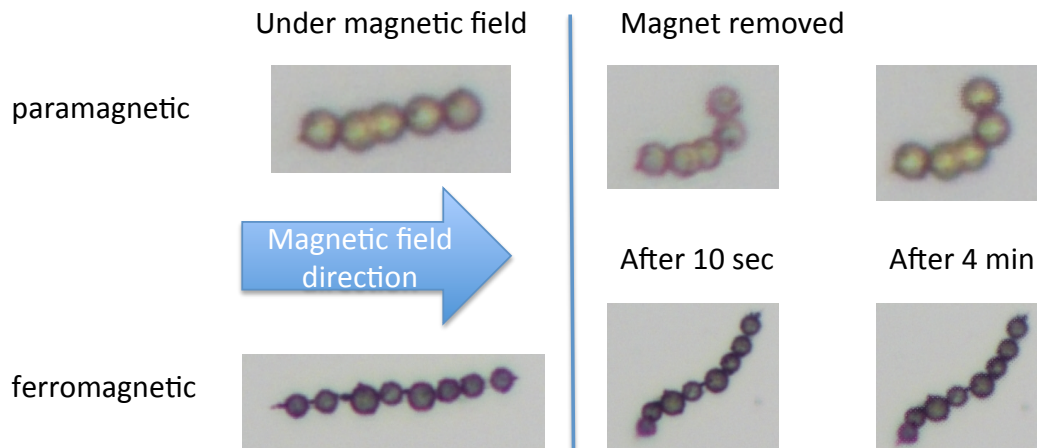
Acceleration versus distance profiles of different size beads. As beads approach the magnetic attraction force is increasing

Figure S4:



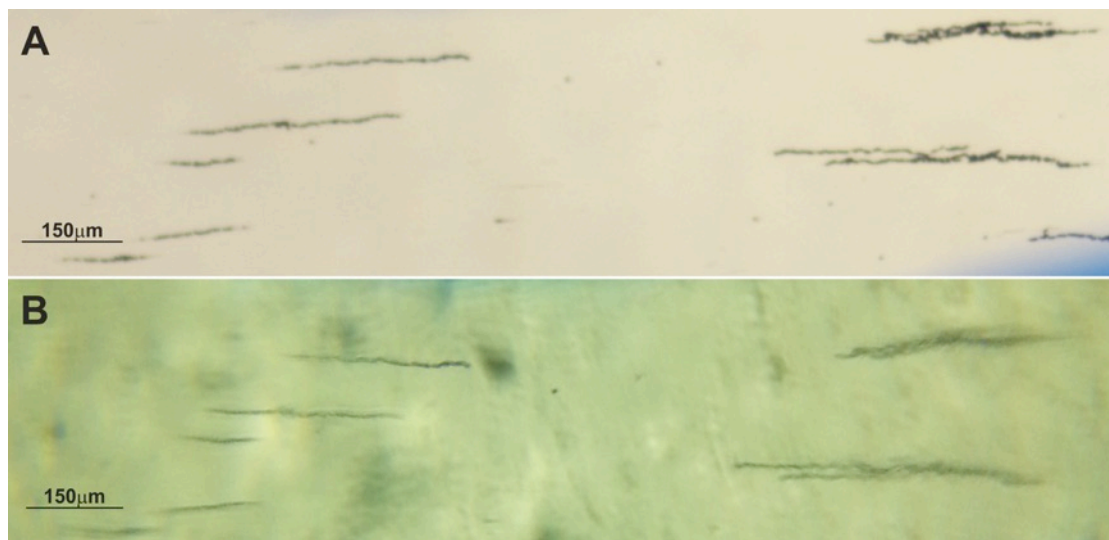
Optical microscope images of the base beads and accumulated iron nano powder flocs. To control the accumulation amount of iron nano powder magnetic field strength is increased. Approximately 9000 particles

Figure S5:



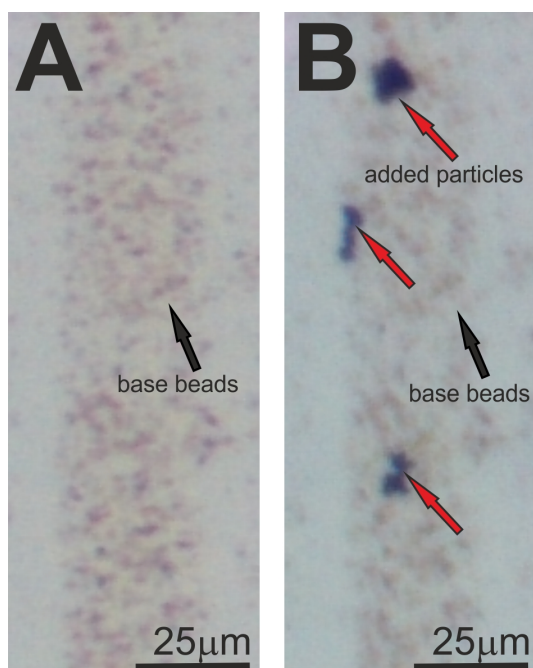
Optical microscope images of 4 μm size paramagnetic and ferromagnetic beads under 12.5 mT magnetic field. Permanent magnets removed and images were taken after 10 seconds and 4 minutes. Note that ferromagnetic beads form longer chains compared to paramagnetic beads.

Figure S6:



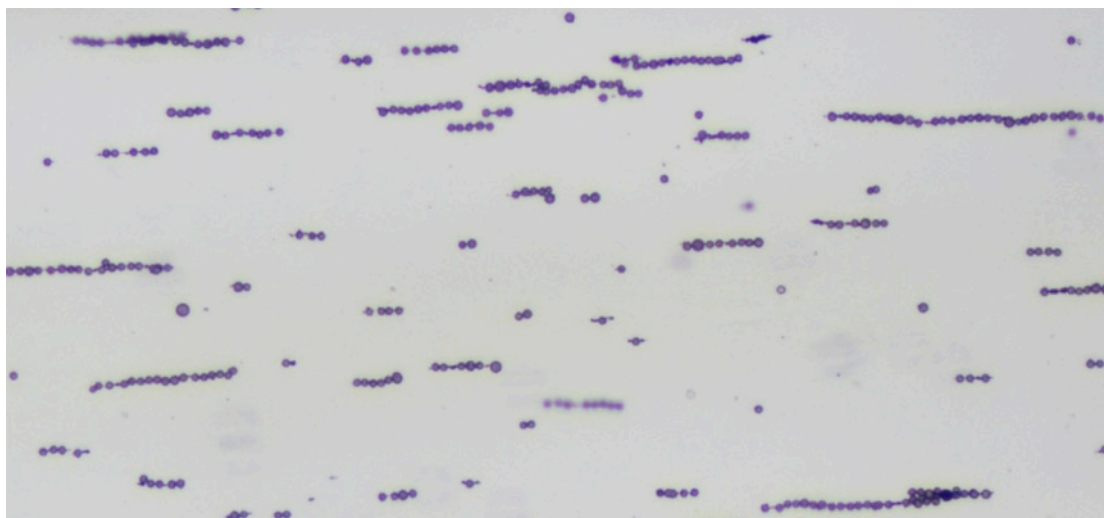
Comparison of the images recorded by the optical microscope (Nikon) with simple cell phone based imaging system. A: Image of a certain area taken by Nikon optical microscope B: Image of the same area taken by a cell phone (Samsung Galaxy Note 2) + simple spherical lens system.

Figure S7:



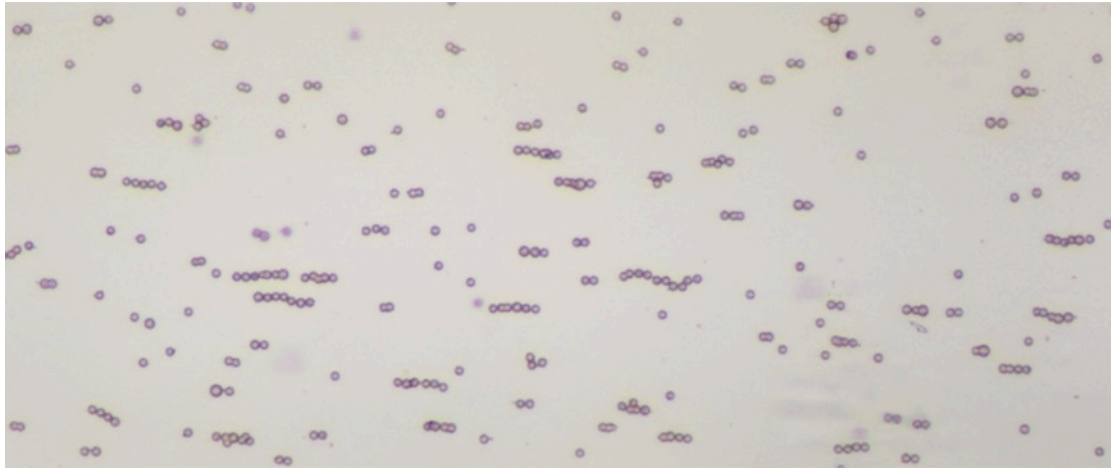
A: Optical microscope images of the immobilized base beads (magnetic particles immobilized on a gold surface using biotin-streptavidin interaction) B: After the iron nano particles injected: many iron particles (indicated by red arrows) accumulated around the surface beads (indicated by black arrows) due to the magnetic dipole-dipole interaction. The images are recorded during slow fluid flow.

Figure S8:



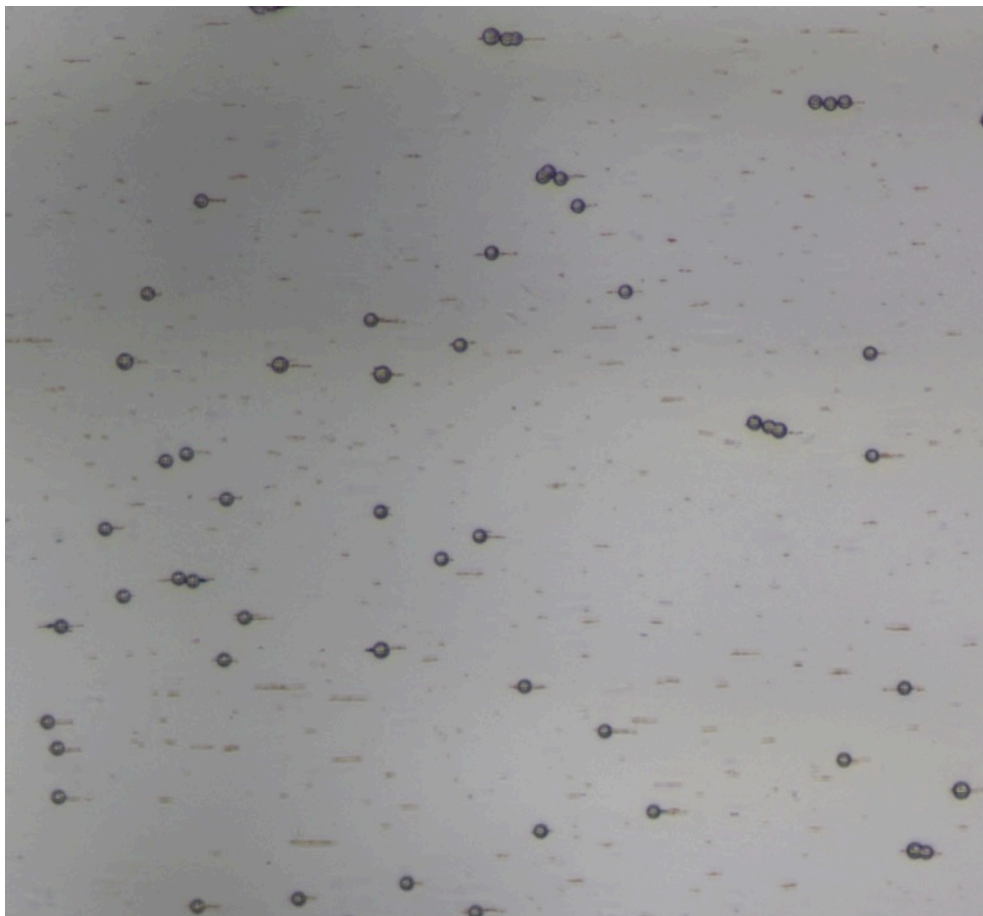
Optical microscope images showing a larger area than presented in the manuscript. Ferromagnetic bead accumulation under applied magnetic field.

Figure S9:



Optical microscope images showing a larger area than presented in the manuscript. Paramagnetic bead accumulation under applied magnetic field.

Figure S10:



Optical microscope images showing a larger area than presented in the manuscript. Tails of superparamagnetic beads formed around ferromagnetic beads.