zone. Dispersing can be achieved by mechanical means, e.g., the vibrational device such as ultrasounds (acoustic), piezo vibrations. The dispersing elements can be functionally coupled to the nBMA device (integrated with chip or the control device).

[0148] In one embodiment, the electromagnetic array comprises magnetic core, e.g., Fe cores, surrounded by power coils, preferably a set of planar coils. As shown in FIG. **17**, the cross sectional areas of the core of the electromagnet could have various geometries such as a star (FIG. **17**, bottom left) or a circle (FIG. **17**, bottom right). Generally, cores having the star cross-section produce a more even magnetic filed between two adjacent cores while cores having the circular shape produce a concentrated magnetic field in the region where two adjacent cores are closest. Thus, by appropriate choice of the cross-sectional areas of the cores, the electromagnetic array could have regions with substantially uniform or concentrated magnetic field.

[0149] The electromagnetic array creates magnetic field gradients that are sufficient to transport the magnetic particles in the fluidic device. The power coils can be switched by the switching circuitry, which in turn can be controlled by a computer. The switching could be on/off, high/low and/or at a desired frequency, which can be determined as a function of the time necessary for a magnetic particle to be transported within the fluidic device.

[0150] FIG. **18** shows an embodiment of the switching circuitry. The computer generates low current signals which are used to control the high current needed for the electromagnets. The current for each coil can be controlled by either a solid state or electromechanical relay or current amplifier which is driven by a logical or analog signal generated by the computer control. FIG. **18**A is an example of a circuit for an individual magnetic element for which the polarity can be switched. So one would need two switches per element of the magnetic array. However, by the switching circuitry of FIG. **18**B, it would be possible to minimize the number of switches but keep the polarity fixed such that, for example, for N elements containing N coils, one would need just 25+N/5 switches.

[0151] FIG. **19** illustrates an example of the movement of magnetic particles on a microscope slide. Initially, in FIG. **19** (1), a liquid solution containing colored magnetic particles was spread out on a portion of the slide overlaying directly above three core/coil elements. Note that the microscope slide in FIG. **19** has been moved down to take the picture, but in the experiment, the liquid solution was on top of the three core/coil elements. Next, all three elements were switched on to have north (N) polarity. As a result, as illustrated in FIG. **19** (2), the magnetic particles in the liquid solution separated into two distinct regions above the first and third core/coil elements. Next, the three elements were switched on to have south (S), N, N polarity. In this case, as illustrated in FIG. **19** (3), the majority of the magnetic particles moved to a spot between S and N polarity elements and some magnetic particles formed a spot above the third element having N polarity. Next, the three elements were switched to have zero (no), S, N polarity. In this case, as illustrated in FIG. **19** (4), the magnetic particles moved to a spot between the second and third elements having S and N polarity. Finally, the three elements were switched on to have zero, zero and N polarity. In this case, as illustrated in FIG. **19** (5), the magnetic particles moved to a spot above the third element having N polarity. This example clearly demonstrates that a magnetic array within the embodiments of the invention can transport and/or concentrate magnetic particles within a fluid without any external fluid transport mechanism that generates hydraulic pressure for fluid transport.

[0152] FIG. **20** shows a prototype system for transport of magnetic particles, the system comprising coil (inductor) array, switches and other electronic control elements, together with a prototype fluidic device (e.g., biochip). The prototype system of FIG. **20** was used to demonstrate transport of magnetic particles in the biochip, illustrated in FIG. **6**. FIGS. **6** and **19** illustrate that the transport and/or concentration of magnetic particles demonstrated in FIG. **16** for a three coil array is scalable for any number coils.

[0153] FIG. **21** shows the specification for an embodiment of the prototype system of FIG. **20**, indicating the magnetic coil structure and magnetic field strengths relative to the coil head surface. As one would recognize, the magnetic field strengths would depend on the spacing of the coils, and the spacing could be varied in different electromagnetic arrays.

[0154] Embodiments of the invention are directed to devices and methods for detecting the presence of an analyte in a sample. According to one embodiment, the device comprises a fluidic network comprising a plurality of fluidic zones, each fluidic zone being connected to the adjacent zone by a diffusion barrier, and an integrated circuitry component. An array of magnetic microcoils is functionally coupled to the fluidic network, which are programmably activatable to generate a magnetic field in proximity to each microcoil. The microcoil array can be integrated into the network, or it can be located near the fluidic zones of the device, so that at least one microcoil is placed suitably for generating a magnetic field in at least a portion of a fluidic zone. A detection element is also functionally coupled to the fluidic network; it can be integrated into the network or located in proximity to the network. Generally, it is situated so that whether integrated or temporarily coupled, it detects optical or electrical signals from one or more of the fluidic zones. A vibration element can also be functionally coupled to the network; it can be integrated into the network or located in proximity to one or more fluidic zones. Typically, when activated, the vibration element is so situated that it will achieve the desired effect of shaking or agitating fluid within one or more fluidic zones of the device.

[0155] Certain embodiments of the invention are self-contained such that liquid does not flow through the fluidic zones, thereby eliminating the need for flow controllers. In such embodiments, the magnetic particles and any molecules bound to the magnetic particles are moved through the liquid contained within the fluidic zones by activating the magnetic microcoils, and are not moved by the flow of the liquid. Typically in these embodiments, the fluid is present in the fluidic zones to act as a suspending agent. Other embodiments of the invention comprise a flow controller for coordinating liquid flow through the fluidic zones of the device. In such embodiments, the magnetic particles and any molecules bound to the magnetic particles are moved through the fluidic zones by activating the magnetic microcoils and/or also can be moved by activating the flow controller to move the liquid itself. The flow controller is functionally coupled to the network: it can be integrated into the network or external to the network.

[0156] The fluidic zones of the device typically comprise a reservoir, channel, groove, opening, or conduit in the substrate of the fluidic device, which is configured for containing a liquid and optionally for containing reagents. In one