Microfluidics System For Detection of Adulterants in Fluids

Principal Investigator: Dr. (Mrs.) Jayu Kalambe

RCOEM, Nagpur

Co-Investigator: Ms. Sakshi Rana

RCOEM, Nagpur

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1. INTRODUCTION

Microfluidics is the science of manipulation of small amounts of fluids through channels with dimensions in the micrometers range [1]. In microfluidic system, the main aim is to move from the dealing of fluids from container to container using manual equipment, and integration of the whole process into a device. The volumes are small and the reaction times are also fast.

The main objective is to develop an automatic sensing system which is portable and which provides results within a short time for the detection of adulterants in fluids.

Adulteration of milk is a common problem. Determining whether the milk is pure or not is a very difficult task. In this work the proposed automated sensing system is used for the detection of adulterants present in milk.

2. PROTOTYPE DEVELOPMENT METHODOLOGY

The methodology used for fabrication of channels is divided into the following stages:

1. Preparation of Mold
2. PDMS (Polydimethylsiloxane) curing
3. PDMS bonding

Three types of molds were prepared as shown in Fig. 1.

Fig. 1. Photographs of mold preparation with PET
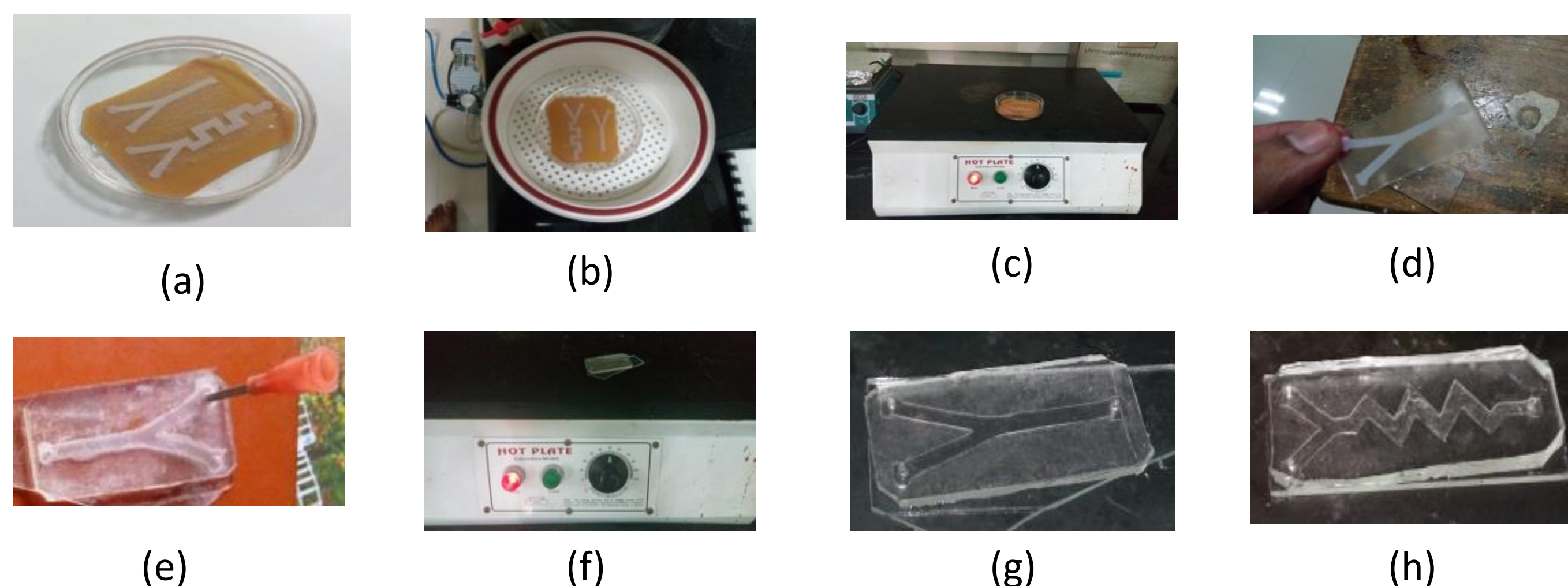

(a)   (b)   (c)   (d)

(e)   (f)   (g)   (h)

Fig. 2. (a)-(h) Prototype Fabrication Process of channels using PDMS material

3. FABRICATION OF MICROFLUIDIC CHANNELS

PDMS is the most widely used material for the fabrication of microfluidic devices [2]. The steps involved in the fabrication:

(a) Photolithography used to prepare a mold for PDMS.
(b) Liquid PDMS is poured on the mold and cured.
(c) The PDMS is then peeled from over the mold.
(d) The PDMS sealed to a flat surface to form the base of the microchannels.

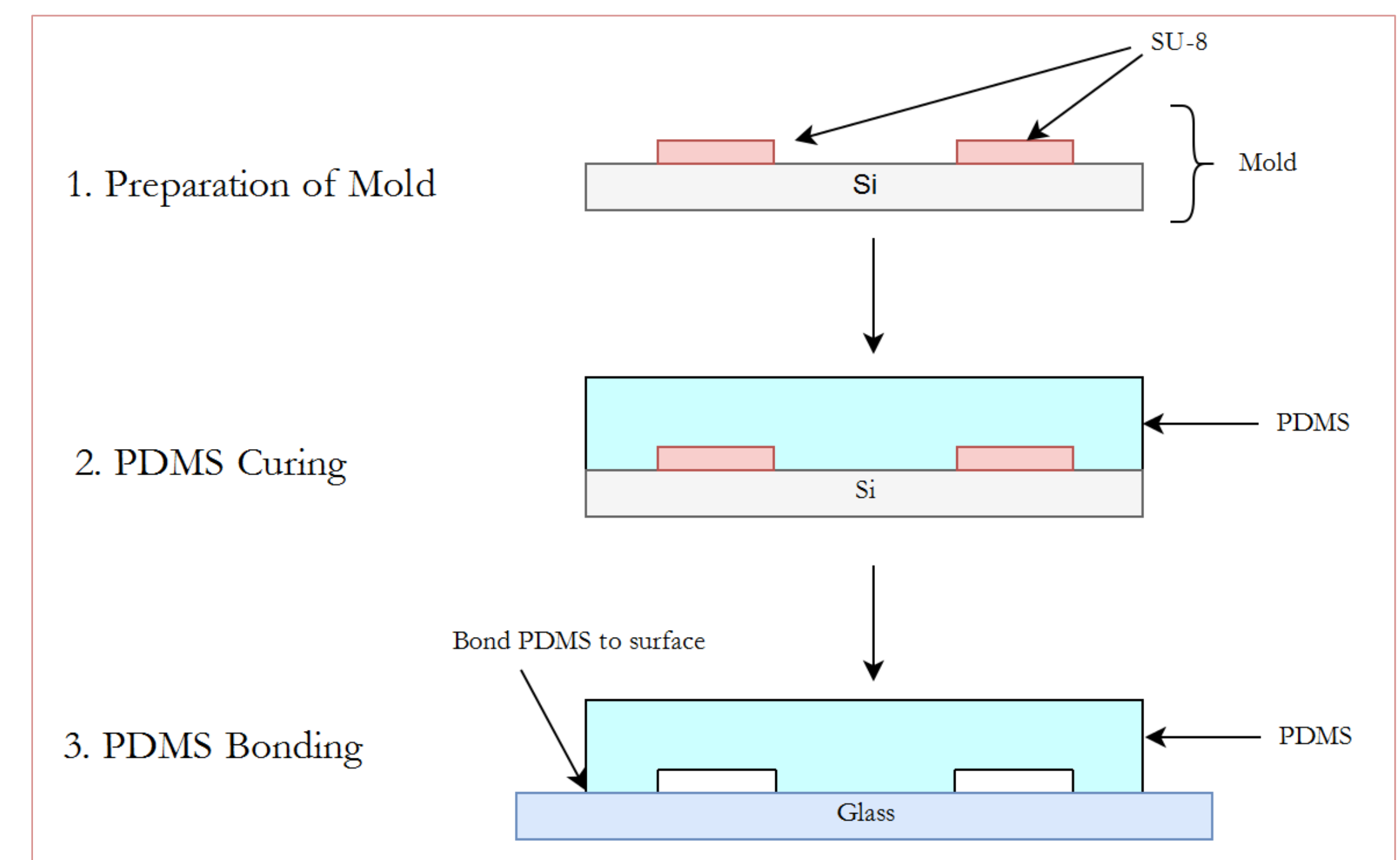**Fig. 3. Flow for fabrication of microfluidic channels**

4. PROPOSED AUTOMATED SYSTEM FOR ADULTERATION DETECTION IN MILK
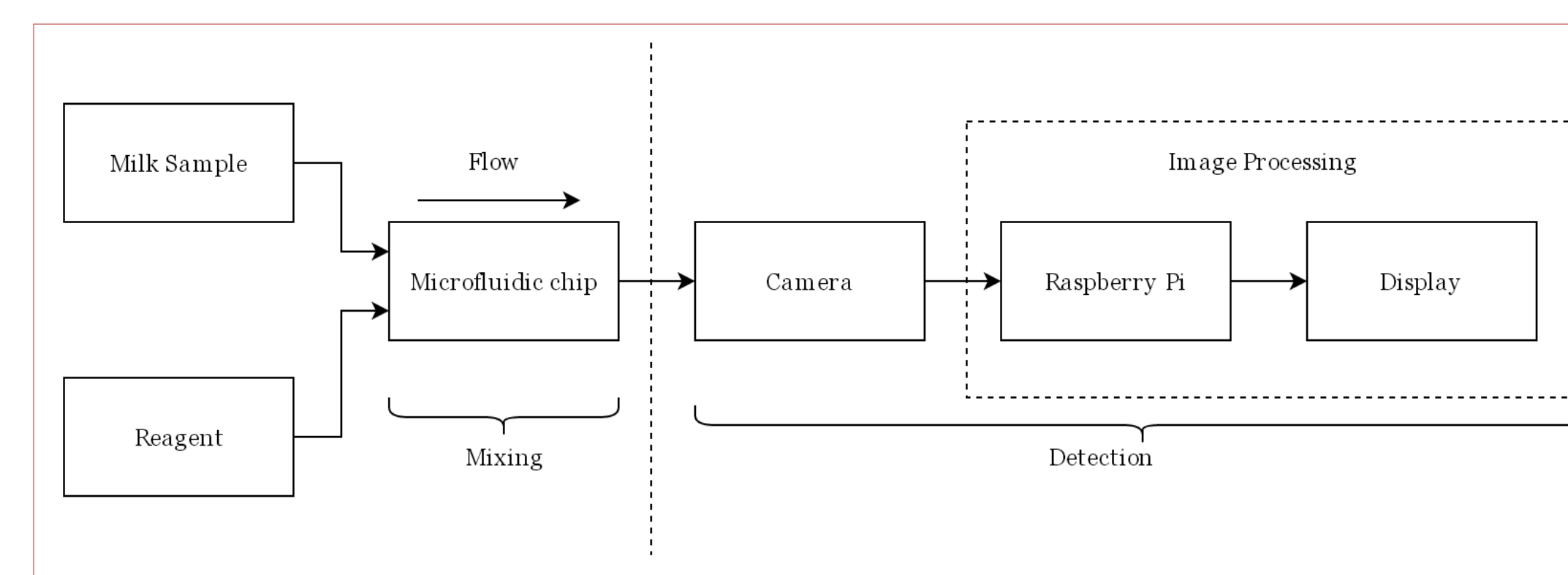

Fig. 4. Block diagram of system for detection of adulteration in fluids

The method employed for adulteration detection is colorimetric detection method. The main element of this system is the microfluidic chip which is using for mixing the reagents with the fluid under test. An embedded system built using Raspberry Pi processes the camera image and displays whether the milk is adulterated or not.

CONCLUSION

In this work, an automated system has been proposed for the detection of adulteration in fluids. The microfluidic chip acts as a passive mixer for mixing of the fluids. This system can further be extended in order to determine the adulterants present in other fluids.

References:
[1] Whitesides, G.M., "The origins and the future of microfluidics", Nature, 442(7101), 368-373, 2006.
[2] Wu H, Huang B., Zare R.N. (2005)"Construction of microfluidic chips using polydimethylsiloxane for adhesive bonding. Lab Chip 5: 1393-1398.

PG Students associated with this project: Mr. Prakash Rewatkar, Ms. Sakshi Rana