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Smartstick for visually impaired person using Arduino

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Smartstick for visually impaired person using Arduino

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Inspiration for the project.....

- The Student's Granddad, who had partial blindness suffered from movement restrictions.
- He desperately wanted to continue his daily morning walk in the nearby vicinity personally.
- We wanted to build it such that he could reach out to his front and backyard (an approximate distance of 150-350 mts or so), and achieve the task without support of any other family member using his Smartstick only.
- This inspired us to build up this DIY.

Introduction

- As we all know that many people suffer from a total or partial blindness due to variety of reasons ranging from night-blindness, cataracts, glaucoma, albinism or injury/accidents.
- The end user in our case is a young gentleman of 65 years age and the target is to enable him to undertake his morning walk independently.

Innovation

- It is observed that in general for people beyond 60 years of age, their hearing power is also reduced significantly.
- Hence a buzzer based system alone would not have sufficed.
- The innovation is in terms of placing a vibrating motor that would definitely warn him about the upcoming obstacle apart from a buzzer and a switch that would allow him to choose his dependent or independent mode.
- It also provides an estimate of the direction of the obstruction

List of components

- **Microcontroller** Development Board Arduino Uno
- **Ultrasonic transceivers**
- SNR1 HC-SR04
- SNR2 HC-SR04
- SNR3HC-SR04
- **Buzzers and Vibrators**
- SND1Piezo-electric buzzer
- SND2Vibrating motor
- **Switches** S1 Toggle switch

Control mechanism for obstacle detection.

Distance	Operation
For distance > 1.4m	No Buzzer
For 0.7m < distance < 1.4m	Buzzer
For distance < 0.7m	Buzzer + Vibration

These sensors require a power supply of 3.3V each to operate up to a distance of 3 m and can detect obstacles within an average angle of 25 degrees in the sphere.

The sensors, their echoes and the pins

- Two of the four pins of these three sensors namely Vcc & GND are connected to Arduino's 3.3V power output. The remaining two pins – TRIG & ECHO are connected to Arduino as follows.

Sensor No.	Trig	Echo
SNR1	2	3
SNR2	4	5
SNR3	6	7

Distance calculation

- The sensor would give an electrical response at the ECHO pin of the sensor. This response is the time taken by the wave for a round journey from sensors to obstacle and back to the sensors. For our calculation, we need only the one-way distance. This can be calculated by Arduino using the following formula:

- **Distance = (Duration/2)/29.1**

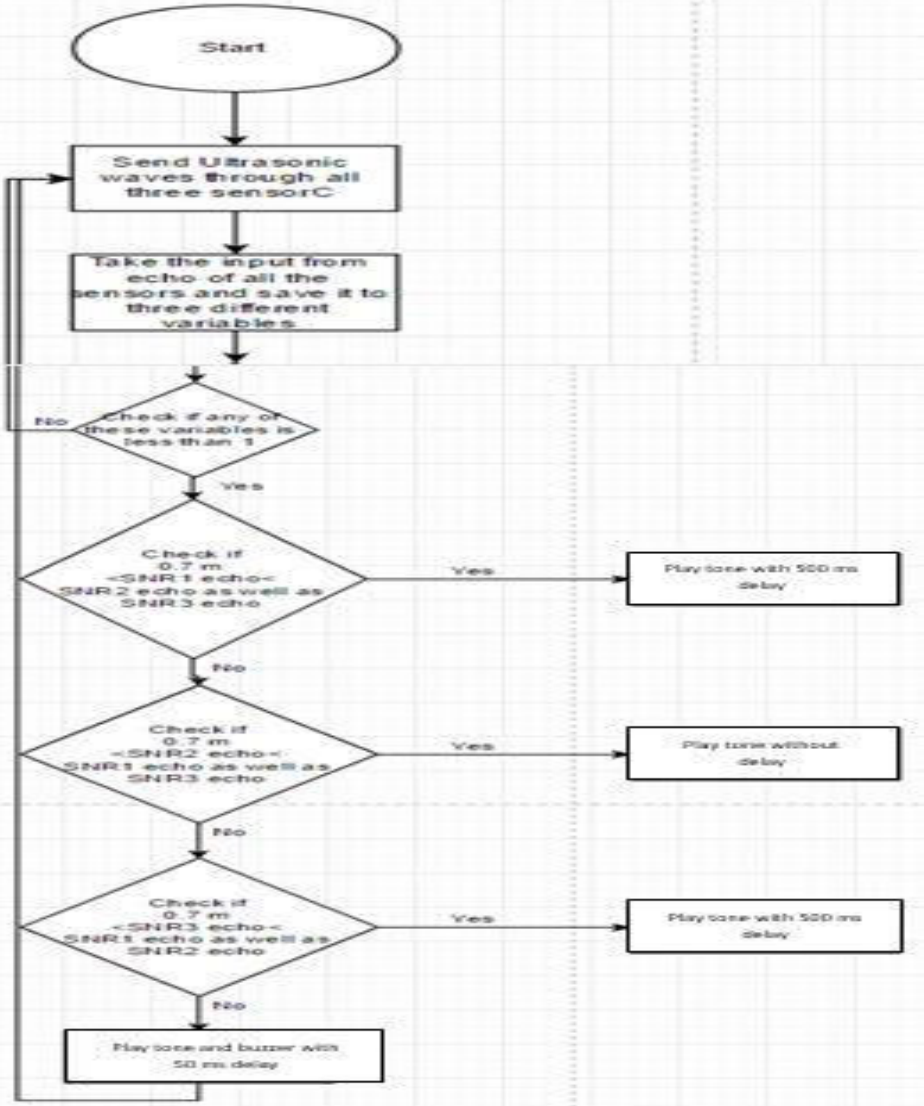
- Here, duration = Echo output; and for only one-way distance, we divide this duration by 2. constant 29.1 is derived as follows:
- The speed of sound is 343.5 m/s or 0.0345 cm/microseconds.
- 1/0.0345 cm/microseconds is 29.1 microseconds/cm.
- Dividing the Duration (ms) by 29.1 (microseconds/cm) gives us the distance in (cm).

Direction and location of obstacle

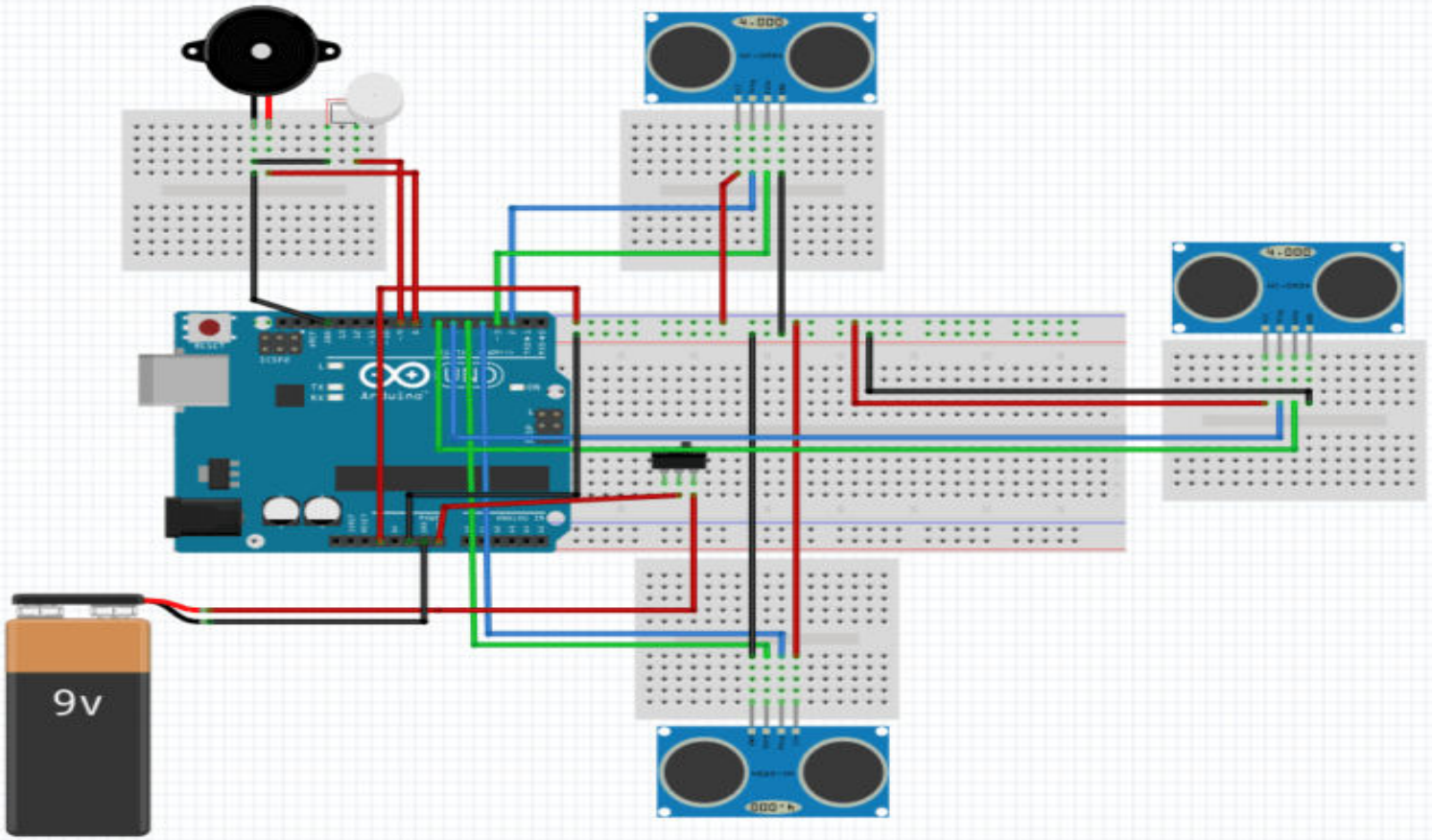
- To distinguish between the direction of obstacle location, the following mechanism is followed:
- For Left and Right side direction locations, the delay is 500 ms.
- For Forward direction location, the delay is zero.
- An additional provision of a motor that vibrates the stick is planted into the assembly for very near obstacles. Experimentation study shows the optimum distance post assembly, to be 0.7m.

Flowchart of proposed system

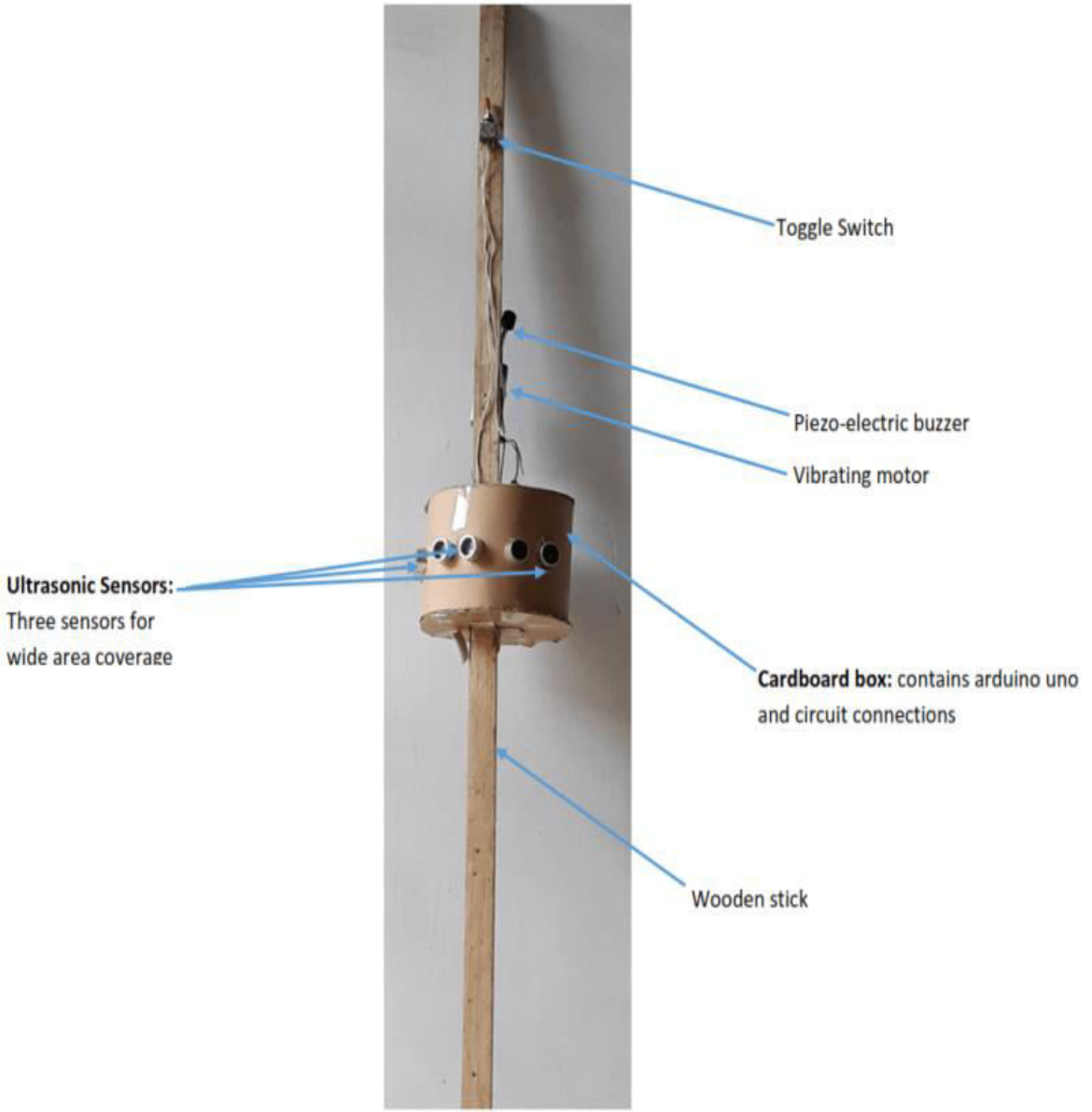
Inputs from all the three Ultrasonic Detectors is taken simultaneou sly to decide upon the direction of obstruction.



The circuitry of the project



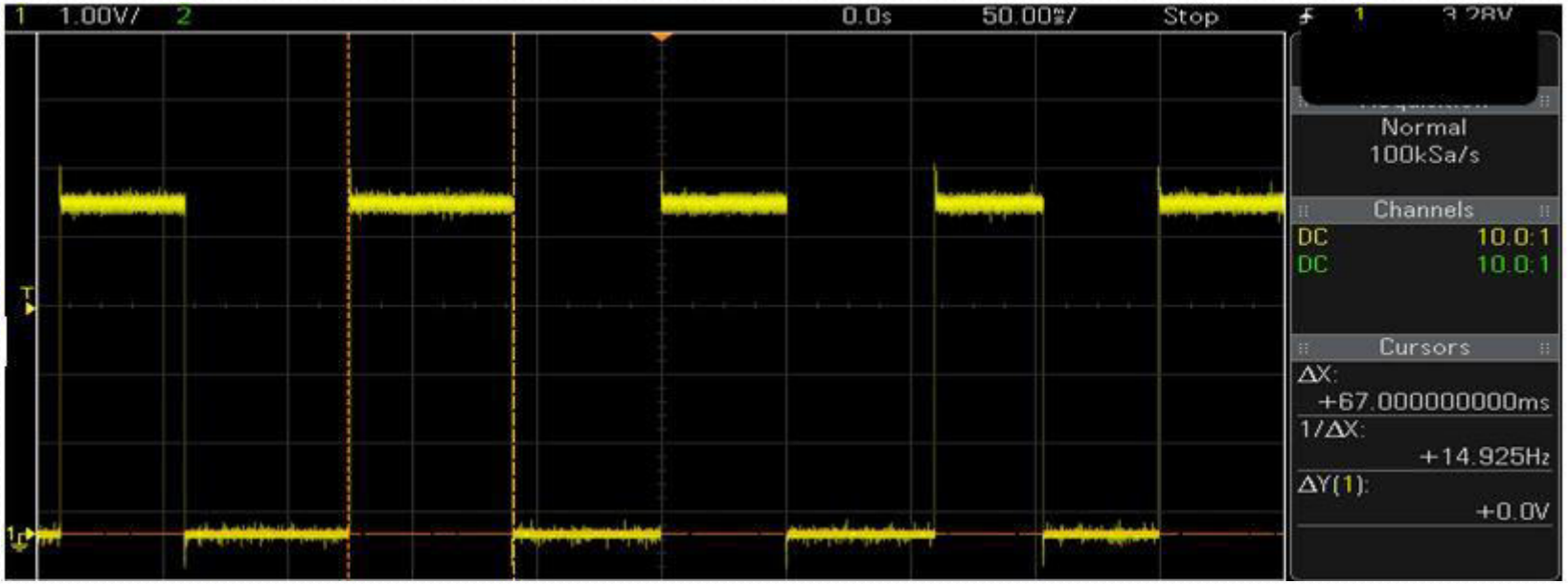
The smartstick implemented using the sensors, the buzzer, motor and toggle switch mechanism



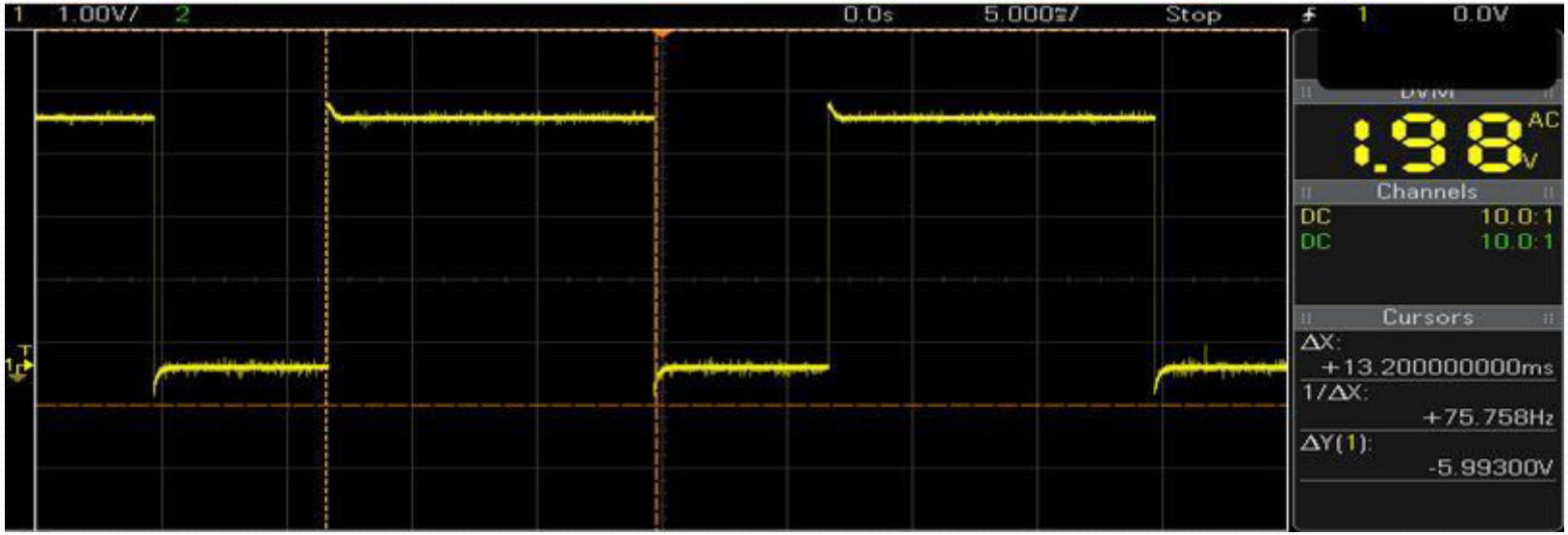
Construction and testing.

Test points	Details
TP0	3.3V
TP1-TP3	3.3V
TP4-TP6	Waveform 1
TP6-TP9 without any obstacle	Waveform 2
TP6-TP9 with obstacle	Waveform 3

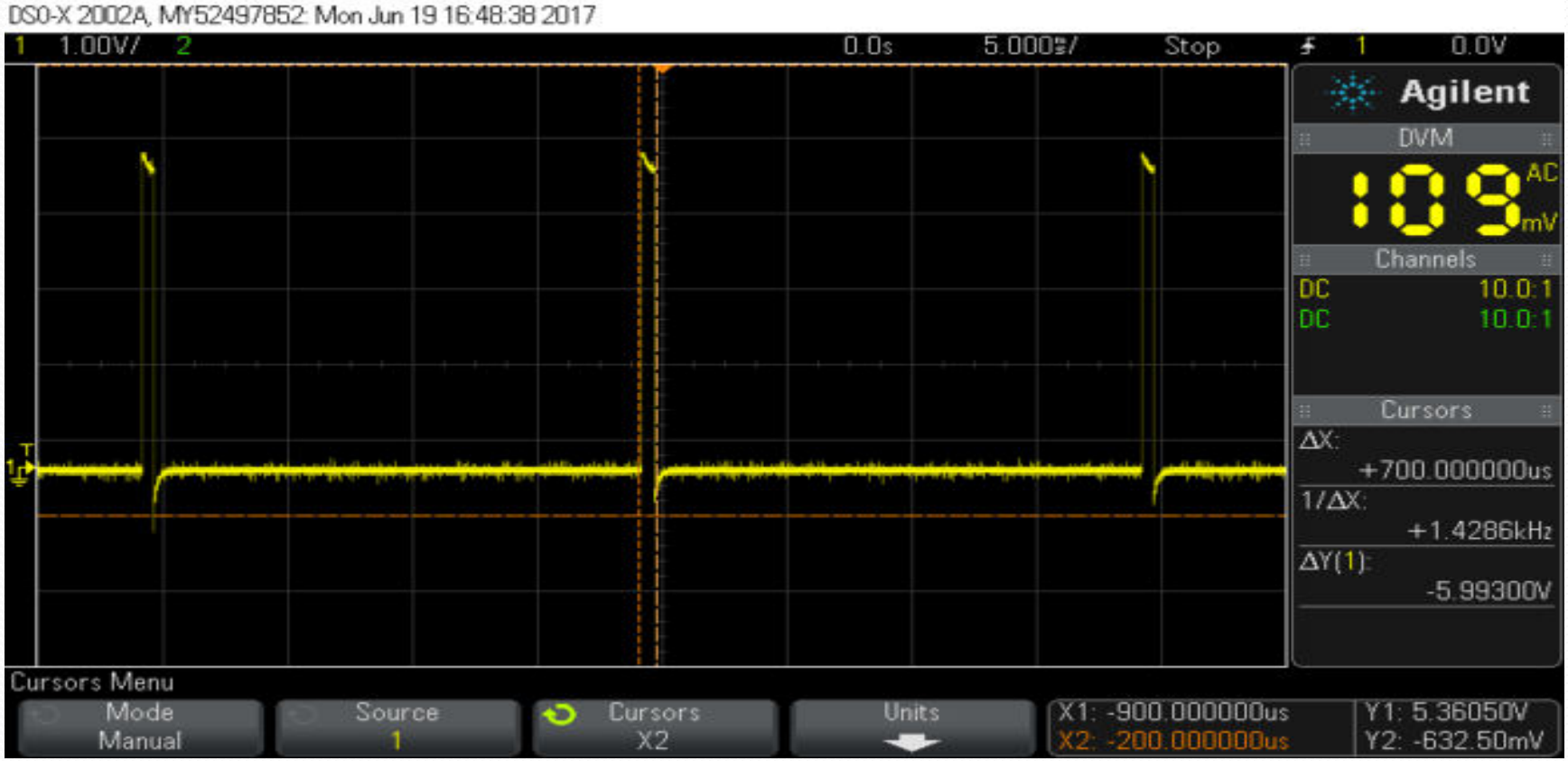
Waveform 1 (as recorded on DSO)



Waveform 2 (as recorded on DSO)



Waveform 3 (as recorded on DSO)



Thank you