**Motivation**
- Develop a portable sensor package that helps layout the interiors of hazardous buildings.

**System Architecture**
- Sensor package comprises of two distance sensors, two Inertial measurement units (IMU), two video sensors (webcams), a microcontroller (Arduino) and a minicomputer.
- The data collected by the sensors through the microcontroller and minicomputer are processed on the minicomputer and transmitted wirelessly to an external processing station.
- The processing station would fuse the data coming out of the sensor package and attempt to provide a coherent representation of the interior of the room.

**Implementation**
- **Ultrasound Sensors**
  - The two ultrasound sensors stream continuous distance measurements through the Arduino.
  - Distance data is packaged into a .dat file comprising of two columns of data, one for each sensor.
  - The data coming out of the ultrasound sensors is then plotted in real-time simultaneously for both sensors as shown in Fig. 7.
- **Video Sensors**
  - Implemented simultaneous video stream capture through ZoneMinder application on Raspberry Pi.
  - Set up a dedicated network server on the raspberry pi through a wireless router.
  - The video streams captured by the Raspberry can be accessed wirelessly through an external computer as shown in Fig. 8.
- **IMU’s**
  - The two IMU’s stream continuous accelerometer and gyroscope data through FTDI cable.
  - Accelerometer and gyroscope data is packaged into .dat files comprising of 6 columns of data.
  - The data coming of the IMU’s is then plotted in real time simultaneously for both the IMU’s as shown in Fig. 7.

**Future Work**
- Fuse accelerometer and gyroscope data to gain a better understanding of sensor orientation using either the Kalman filter or the Complementary filter.
- Using the two video sensors to implement a panoramic image stitching algorithm and create a depth map with the distance sensors.
- Researching portability (encasing and power source).

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**Hardware Components**
- Inertial Measurement Units (IMU)
- Ultrasound Sensors
- Cameras (Webcams)
- Arduino Uno (Microcontroller)
- Raspberry Pi (Mini-Computer)
- Wireless Router

**Fig. 1: Proposed System Architecture**

**Fig. 2: Demonstration System Architecture**

**Fig. 3: Real-time plots of data coming out of the IMU’s and ultrasound sensors. The graphs in the first row are the x, y, z accelerometer data for the two IMU’s. The graphs in the second row are the x, y, z gyroscope data for the two IMU’s. The graph in the last row is the distance data coming out of the two ultrasound sensors.**

**Fig. 4: Video streams captured by the Raspberry pi using the ZoneMinder surveillance application. The video streams are being viewed wirelessly on an external computer through a custom network server set up using the wireless router.**