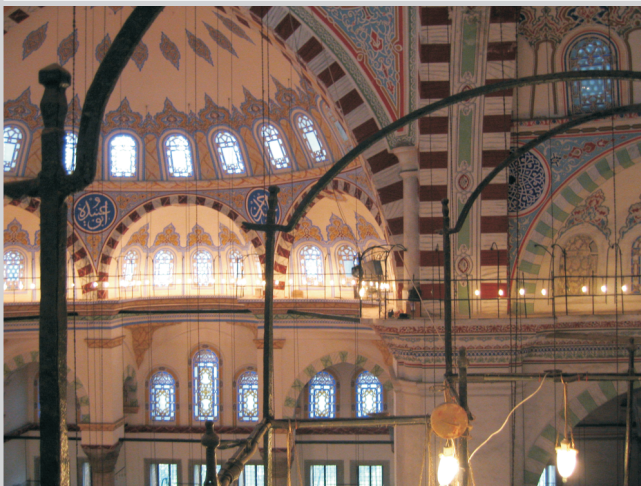




Monitoring culturally significant buildings



The Fatih Sultan Mehmet Mosque in Istanbul was built in honour of Fatih Mehmet II's conquest of the city in 1453. One of Turkey's largest mosque complexes, the site includes extensive precincts and madrasas (religious academies) as well as the central sanctuary.

Istanbul lies in an area of high seismicity, directly on the North Anatolian Fault, and small earthquakes are common. In 1509, forty years after construction was finished, an earthquake badly damaged the mosque buildings. A second earthquake, in 1766, caused the central dome

to collapse; this time, the complex was rebuilt entirely, with only the mihrab, portal and a portion of each minaret surviving.

Recent scientific studies warn that a major earthquake is likely to hit Istanbul in the near future. According to one, the probability of such an event occurring in the next 30 years is 62 ± 12 %. Institutions across the city are working to make sure buildings will be able to withstand the earthquake when it happens.

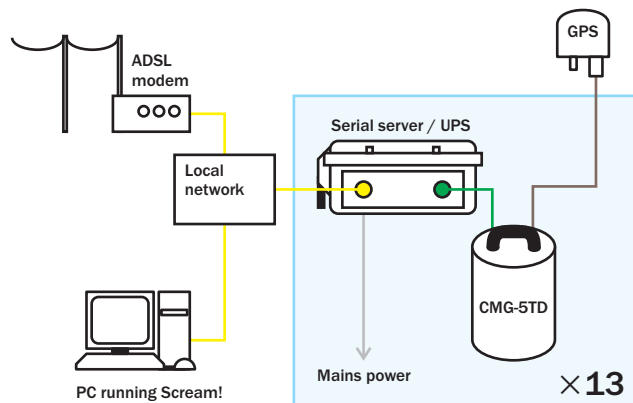


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The experiment



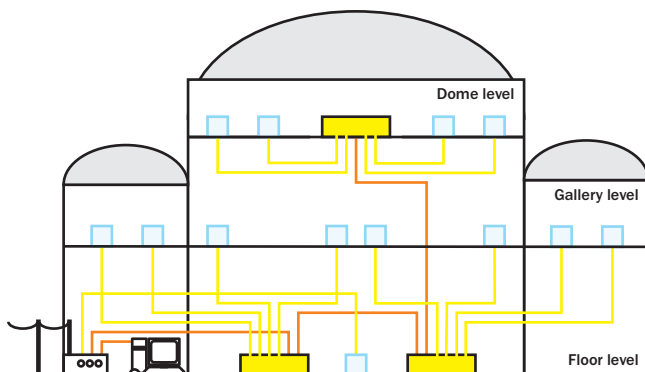
Sentez Electronic & Engineering Ltd were commissioned to set up a strong-motion experiment in the mosque, to record the response of the structure to ground movements and identify areas which will be susceptible to damage.



13 CMG-5TD triaxial digital accelerometers have been installed at locations around the mosque.

- 4 instruments are located at equal spacing around the dome.
- 8 further sensors are spaced about the gallery level.
- A final CMG-5TD placed on the stone floor provides an approximation to the free field.

Each instrument is connected to a Güralp Systems serial server / UPS module, which provides constant power and provides a TCP/IP connection for data streams to a central PC running Scream!. An ADSL modem using NAT provides Internet access for the array equipment and forwards requests for GCF data to the PC's Scream! server.



With this setup, small earthquakes can be detected at the 5TD on the floor and compared with the motion of the sensors on the higher levels. Differences between the traces can be analysed to provide information about the vibrational modes of the building, which is used to decide which areas are in need of strengthening before a large earthquake occurs.

Installation ideas



The digital accelerometer

- The CMG-5TD is a stand-alone digital instrument for strong motion applications.
- It combines a CMG-5T sensor with an internal DM24 mk3 module.
- An LCD display on the sensor lid provides at-a-glance status information, including GPS status and memory usage.
- The 5TD can be supplied with up to 8 Gb of Flash memory for storing recorded data.
- Both continuous and triggered data can be output simultaneously, at

different sample rates. The digitizer can perform the triggering algorithm at a third sample rate if necessary.

- You can set up the 5TD to save triggered data to Flash memory whilst outputting continuous data over the serial port.
- Saved data can be quickly downloaded over FireWire, or requested over the serial link with a terminal command.

Data flow

- CMG-5TD digitizers output data over a standard RS232 link.
- They can be connected to modems and configured to dial out automatically, or to transmit data when another modem dials in.
- The Guralp Systems Serial Server / UPS module contains a simple network converter for transmitting RS232 streams over a TCP/IP link. Scream! can manage these links and collect data at a central point.
- Scream! can also convert incoming streams to various commonly-used formats including UFF (both ASCII and binary variants.)
- For more flexibility, a Linux-based CMG-DCM Data Communications Module can handle practically any networking task.
- The CMG-DCM includes a full Scream! server implementation, and consumes less than 1 W under normal conditions.