

Programmable Embedded Systems (EE60098)

Homework 2

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Q.1 Enlist the Specifications of various Sensors on a typical Smart Phone. Discuss about LIDAR and Life Field Camera.

Sensors is the device which is used in smartphones to detect various aspects of environment. They sense data for which they are made and works according to that. There are various sensors which are available nowadays in smartphones which is in-built and helps in functioning of the smartphone. Basically, they work for better user experience.

Sensors on a typical Smart Phone

- **Compass Sensor**
Extremely common and acts as its name, like a compass.
- **Accelerometer Sensor**
It is most important sensor which should be available in every smartphone. It helps phone to check its orientation.
For Example, if we rotate our phone in landscape mode, then all icons present on screen also moves to landscape mode, and when we want we can change it into portrait mode, this is because of these sensors.
- **Motion sensors**
Motion sensors are used to monitor device movement such as tilt, shake, rotations, flip etc. Typically implemented through an accelerometer.
- **Position Sensors**
Android smartphones provide sensors that let you determine the position of the device geomagnetic field sensor with the help of the accelerometer.
- **Proximity Sensor**
On the top of the screen, it throws out infrared light continuously and detects an object through the reflections. For example, while answering the phone, as you put the phone on your ear, the screen switches off, saving battery as well as preventing accidental touches.
- **Ambient Light Sensor**
Helps in automatically controlling the brightness of the mobile screen. For example if you are in a dark space, then the brightness of the screen decreases, and if you move out into the light, the brightness of the screen would increase. Can also tune its sensitivity to our comfort.

LIDAR

Lidar, which stands for **Light Detection and Ranging**, is a remote sensing method that uses light in the form of a pulsed laser to measure ranges (variable distances) to the Earth. It is sometimes called “laser scanning” or “3D scanning.” The technology uses eye-safe laser beams to create a 3D representation of the surveyed environment. These light pulses—combined with other data recorded by the airborne system — generate precise, three-dimensional information about the shape of the Earth and its surface characteristics.

A lidar instrument principally consists of a laser, a scanner, and a specialized GPS receiver. A typical lidar sensor emits pulsed light waves into the surrounding environment. These pulses bounce off surrounding objects and return to the sensor. The sensor uses the time it took for each pulse to return to the sensor to calculate the distance it travelled.

Airplanes and helicopters are the most commonly used platforms for acquiring lidar data over broad areas. Two types of lidar are topographic and bathymetric. Topographic lidar typically uses a near-infrared laser to map the land, while bathymetric lidar uses water-penetrating green light to also measure seafloor and riverbed elevations.

Light Field Camera

A **light field camera**, also known as **plenoptic camera**, is a camera which captures information about the light field emanating from a scene; that is, the intensity of light in a scene, and also the direction that the light rays are traveling in space. This contrasts with conventional cameras, which record only light intensity.

One type uses an array of micro-lenses placed in front of an otherwise conventional image sensor to sense intensity, colour, and directional information. Multi-camera arrays are another type. Holograms are a type of film-based light field image.

In a 2017 study, researchers observed that incorporation of light field photographed images into an online anatomy module did not result in better learning outcomes compared to an identical module with traditional photographs of dissected cadavers. Plenoptic cameras are good for imaging fast moving objects where auto focus may not work well, and for imaging objects where auto focus is not affordable or usable such as with security cameras. A recording from a security camera based upon plenoptic technology could be used to produce an accurate 3D model of a subject.