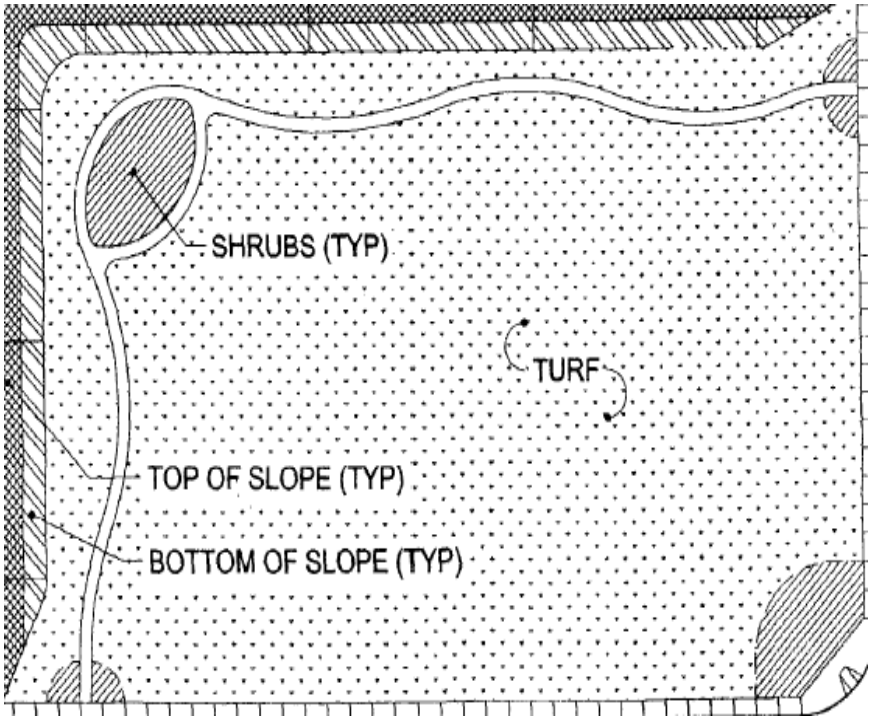
Soil-Water Characterization Unit

Benjamin Mussi

6.111 Final Project

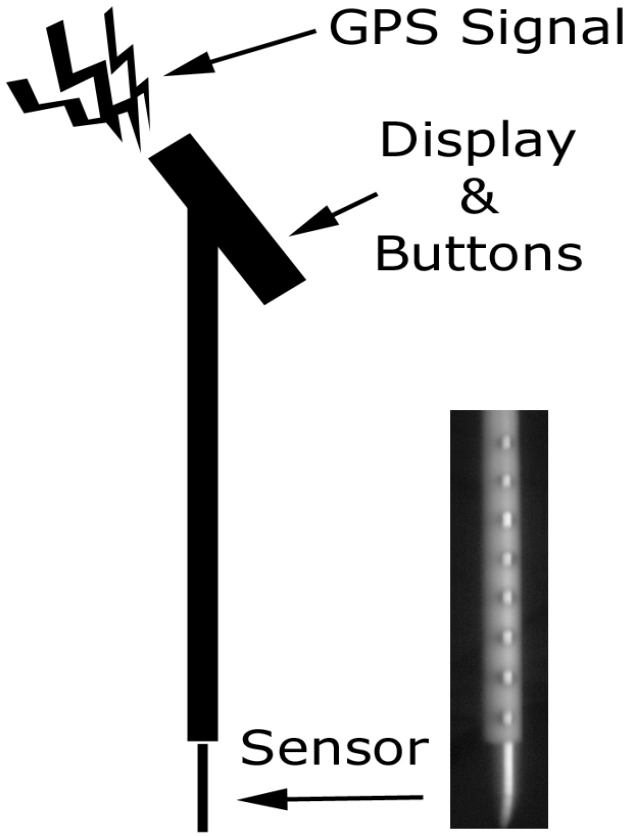
Project Background

- Mandated sprinkler distribution sampling in Southern states
- Current process uses cups to catch water distributed around lawn
- Requires manual recording of levels in cups, positions of cups, and calculation of figures of interest

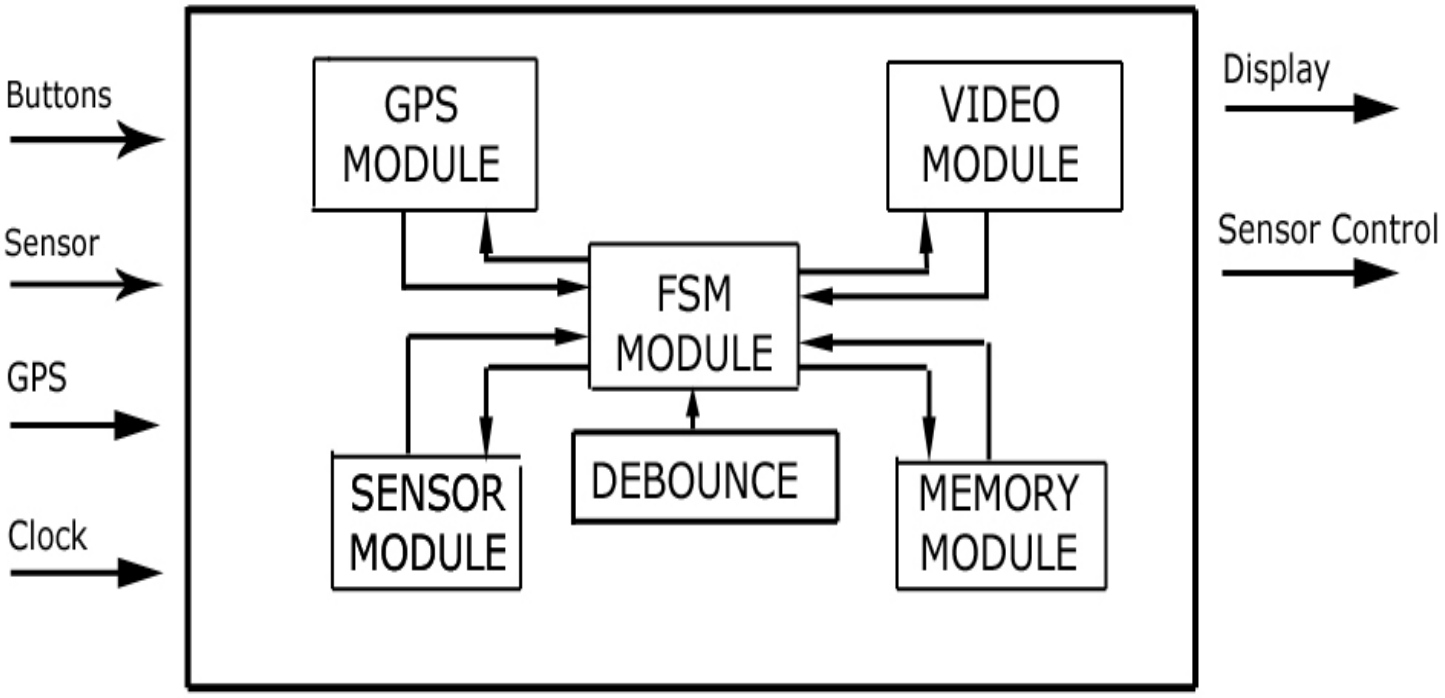


Project Description

- Portable unit that detects saturation levels of soil
- Depth of sensing: 3.5”
  Resolution: 0.5”
- Unit records the date, time, and position of each measurement
- Display gives measurement result and calibration interface

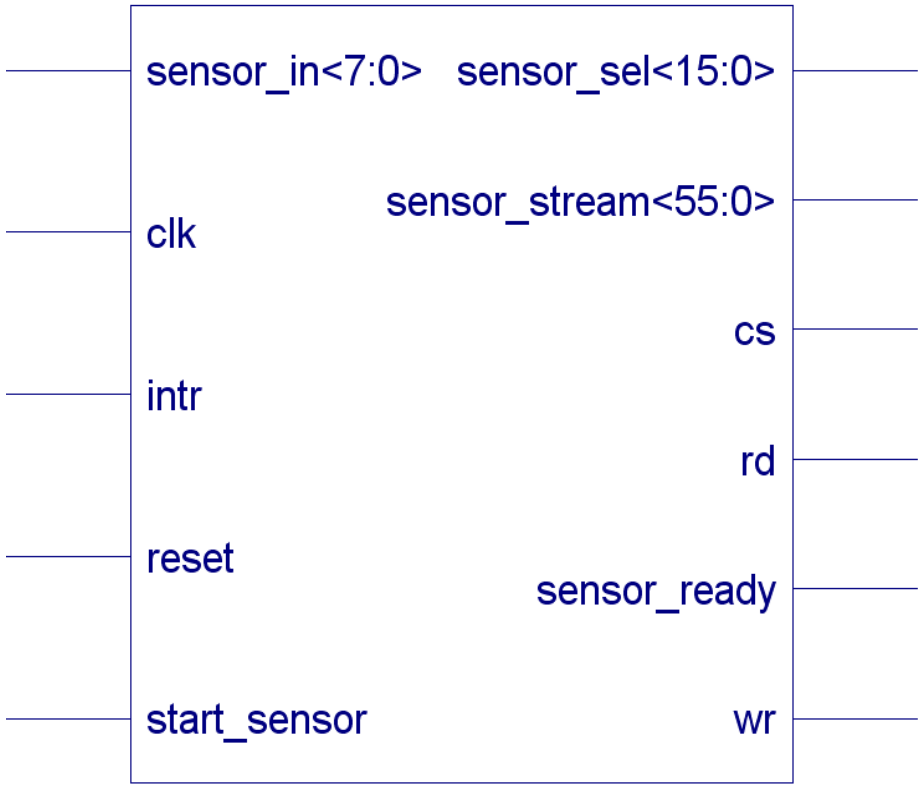


Modular Block Diagram



Sensor Module

- Receives a measurement request
- Sequences pad selections to control circuitry and sends read/write signals to ADC converter
- Receives ADC measurements
- Sends measurement sentence to requestor

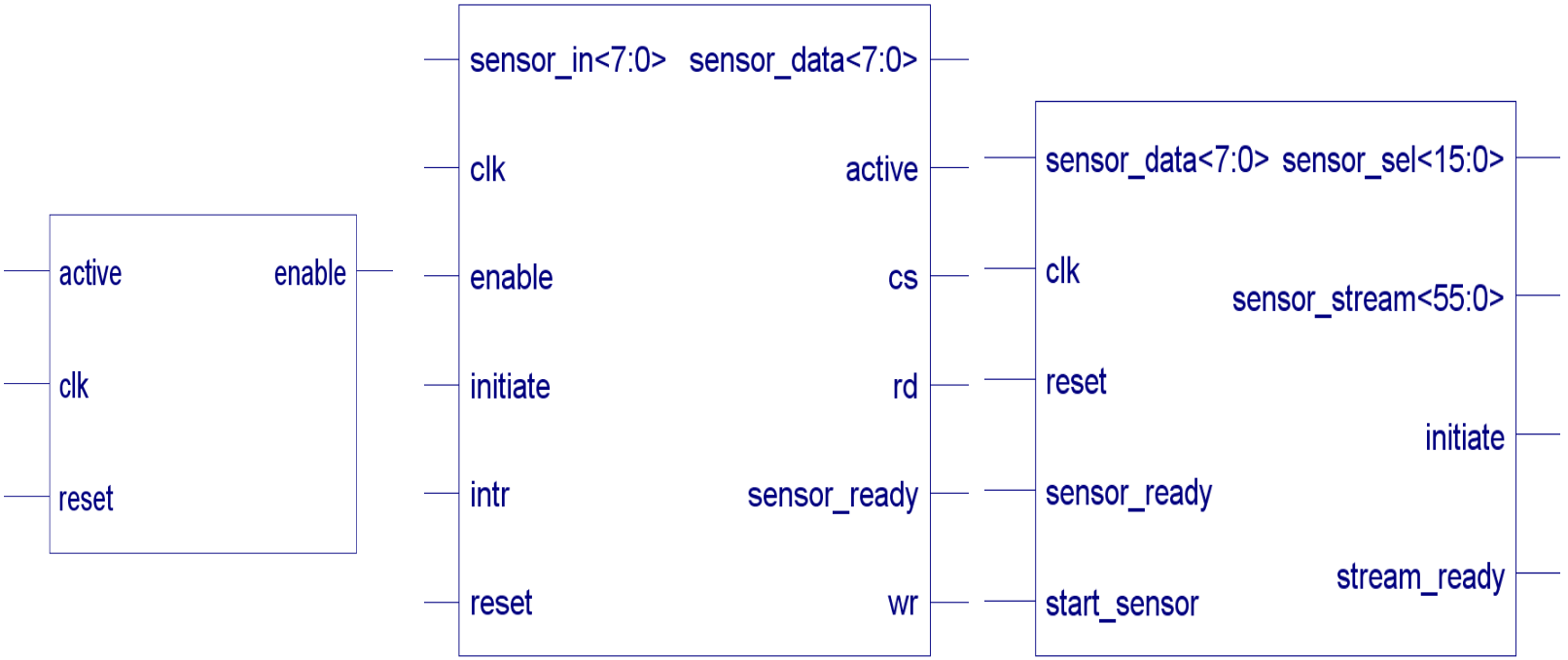


Sensor Module Components

Sensor Clock

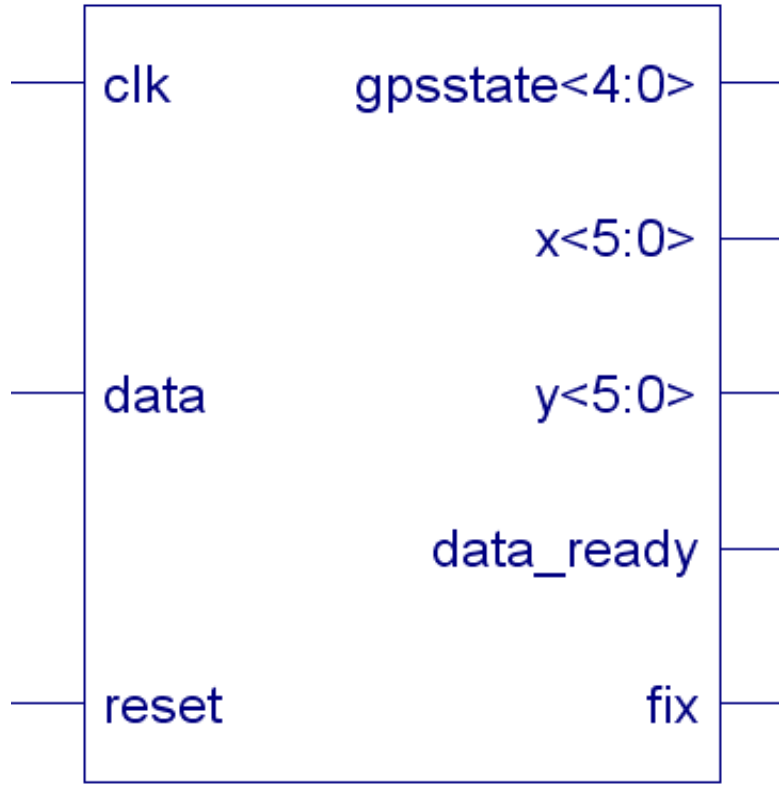
Sensor Control

Sensor Decoder



GPS Module

- Receives a position request
- Samples synchronized GPS NMEA data stream at 4800 baud
- 8-bit ASCII with start/stop bits.
- Structures sentences by counting commas in data stream
- Sends the current latitude, longitude, date, and time to the requestor

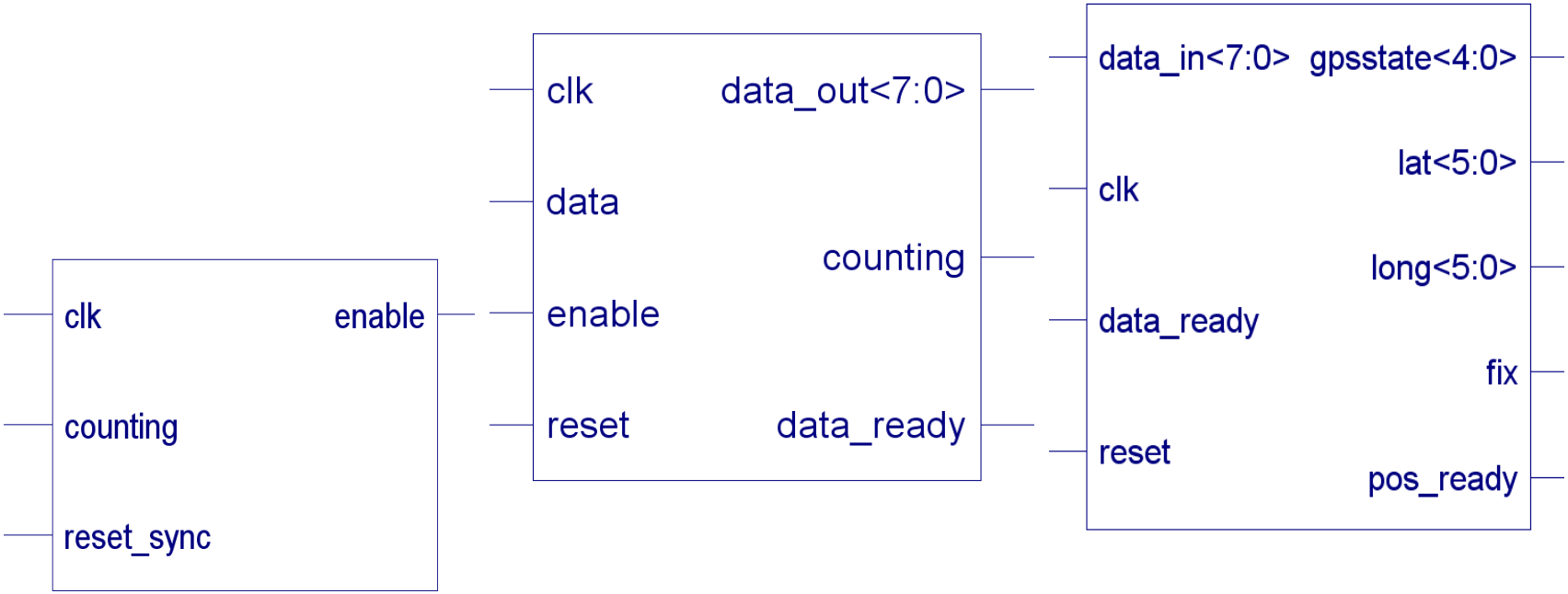


GPS Module Components

RS-232 Clock

RS-232 Decoder

GPS Communicator



Memory and Video Modules

BRAM Memory Module

- Same as in Lab 3
- Sensor: 8x7 - 56 bits
- Position: 8x20 - 160 bits
- Per Measure - 216 bits

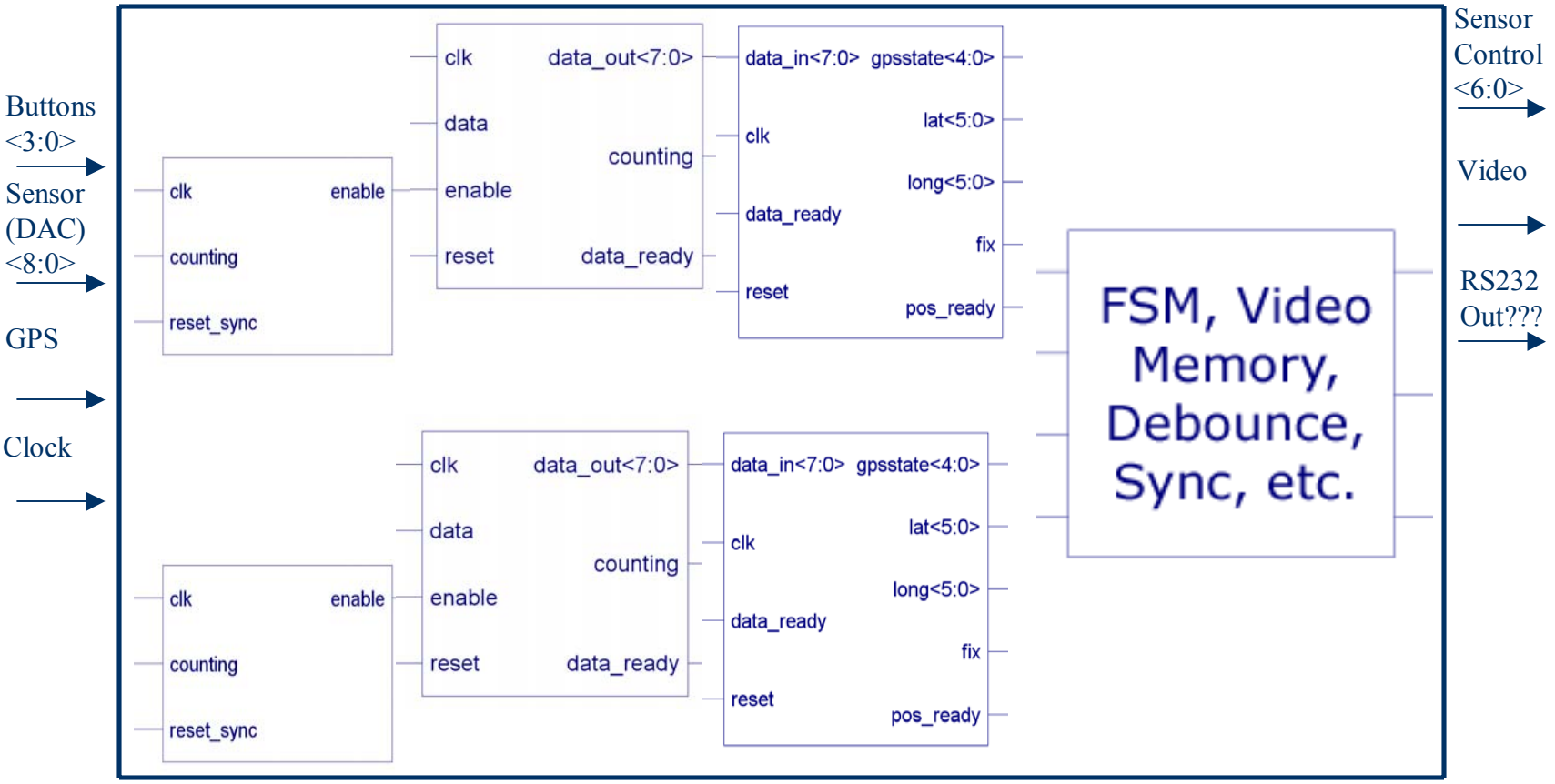
TOTAL:

216x30 - 6480 bits

Video Module

- Verilog code for string display to VGA on course website
- Send GPS information and soil measurement information to 640x480 display

Detailed Block Diagram



Timeline and Extras

- December 3 – Baseline unit capable of calibrating sensor, recording sensor measurements, capturing pertinent GPS information, and displaying to a VGA unit
- Extra (if time permits):
    1) RS-232 export of stored data
    2) Display to a color LCD
    3) Graphical user interface
    4) Visual representation of measurements