Problem Statement
A major trend in modern day production agriculture has been the use of data to improve farm efficiency. The goal of this project was to explore methods to increase the accuracy of yield maps – to bring the “precision” in spatial data collection of “precision agriculture” to a whole different level.

Project Goal:
• Enhance yield maps so as to know yield on a row-by-row basis
• Provide farmers with the ability to better utilize their planting and sprayer technologies which are already row-by-row
• Enable accommodation of micro-climate and micro-topography influences

Impact
The increasing world population will require more food with less land availability. This design will help farmers increase yield and increase environmental sustainability. More food with fewer resources such as water, fertilizer, and herbicides will be a benefit to all.

Economical Benefits
1. Increase yield map accuracy
2. Locate specific areas of lost crop
3. Compare plant response to soil type
4. Evaluate specific nutrient levels
5. Analyze different hybrids
6. Locate specific compaction areas
7. Identify drainage problem areas

Proposed Solution
• Take advantage of existing image processing technologies already used in areas such as:
  o fruit farm yield estimation
  o weed analysis for spraying technology
  o seed processing
• Use one GoPro camera for every 3 rows to optimize resolution
  o camera frame rate capabilities allow combine operation through a full range of speeds
  o camera has proven durability for harsh environments
• Use WIFI enabled components to simplify installation
• Customize image processing software (may require nominally 6 mo. to 1 yr. of programming)

Image Processing Steps
1. GoPro attached to the back of the corn head looking into row unit from above.
2. Computer processes images using software.
3. Software used for mock up: Gimp 2.0 and Paint
4. Ears counted using edge detection.

Basic System Elements
GoPro Hero 3+ Black Edition- $400
  Capabilities: 1080p HD video, 12MP photos, time lapse modes
Computer- $750
  Capabilities: 4 core processing power, terabyte hard drive has the ability to store photos daily
Tablet- $400
  Capabilities: Display app with ear count
GoPro Stand Mount- $15
  Capabilities: Provides the desired height and angle needed to achieve the optimum image
Software: C programming language

Limiting Factors
1. Ears often bounce out of the row
2. Limited space for hardware components
3. The environment in this area is not conductive to delicate electronic components
4. Inability to separate individual ear weights and plant readings

Alternative Solution
• Electronic sensor to detect ear weight
• Ears pass over load cell located behind deck plates
• Millivolt reading is processed and converted into weight

Systems Integration
• System works in conjunction with the pre-existing mass flow sensor.
• Compares percentage reading from the software with mass flow total yield number
• Operator has the ability to view yield data on a row-by-row basis

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