IP4Cam

Image Processing from a Camera-type Device
ELECOMP Capstone Design Project 2017-2018

Sponsoring Company:

IGT Global Solutions Corporation
55 Technology Way
West Greenwich, RI 02817
Phone: 401-392-1000
https://www.igt.com/

IGT is continuing their support of the Program they initiated last year:
http://web.uri.edu/elecomp-capstone/past-projects-2016-2017/igt-jackpot/
http://web.uri.edu/elecomp-capstone/past-projects-2016-2017/igt-windfall/

Company Overview:

IGT is the world's leading end-to-end gaming company. It is listed on the New York Stock Exchange under the trading symbol "IGT." Its holding company headquarters are in the United Kingdom, with operating headquarters in Rome, Italy; Las Vegas, Nevada; and Providence, Rhode Island. IGT attracts the industry's top talent, with more than 12,000 employees across the globe.

IGT's integrated portfolio of technology, products, and services, including its best-in-class content, is shaping the future of the gaming industry by delivering the innovation that players want.

IGT is uniquely positioned to provide the government-sponsored and commercial gaming industry with proven solutions for gaming, lottery, interactive, and social, through every channel across the spectrum, including retail, web, and mobile. It is IGT's mission is to be the global innovation leader in the gaming industry.

Our vision to combine the best of our legacy companies to enhance and build our capabilities; deliver content, technology, and expertise that drive customer and player demand; continue to

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grow leadership in the lottery and gaming space, and become a leader in the interactive space; and use the power of our understanding of central systems and connectivity to define the future of gaming.

Technical Directors:

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*Bruce Parkes led last year's **IGT Jackpot** team which was placed second at the 2017 May Summit Competition*

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Project Motivation:

Lottery terminals have been doing image processing at the retailer counter for as many years as there have been online lottery terminals. Tasks range from reading standard and proprietary barcodes to reading player selections from playslips to handwriting recognition for form processing.

Traditionally images were captured using technology similar to a flat-bed scanner. With this type of image capture, image processing is relatively simple because the scanned document appears flat, at a known scale, and with uniform illumination. For a little more than a decade now, IGT has been developing and deploying camera readers to perform the same functions. Camera technology has many benefits for business such as improved reliability (no moving parts) and lower cost overall. From an image processing standpoint cameras present many

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changes:

- Varied lighting.
- Varied scale and rotation.
- Documents stacked upon one another.
- Folded and uneven documents.
- Obstructions
- Movement

This project will develop image processing algorithms to address some of these challenges.

Anticipated Best Outcome:

Output images of a quality to be able to perform playslip reading, optical character recognition (OCR), barcode reading, and human readable handwriting recognition.

Project Details:

The hardware environment will be a camera positioned firmly above a platen where documents will be placed for image capture. There will be light fixtures positioned around the camera to provide varied illumination environments ranging from bar-light to full sunshine with shadows crossing the document being imaged.

One task will be to capture an 8.5x11 inch document for human reading purposes by splicing together three captured images of different portions of the document to produce one single document.

Another task will be to combining two to three images taken at different exposure and illumination settings to produce a single High Dynamic Range (HDR) image.

A more advanced task would be to identify the boundaries of a document and produce an output image that contains only the document with all of the topography and lighting aberrations eliminated.

All image processing will be performed on color images and require no human interaction while

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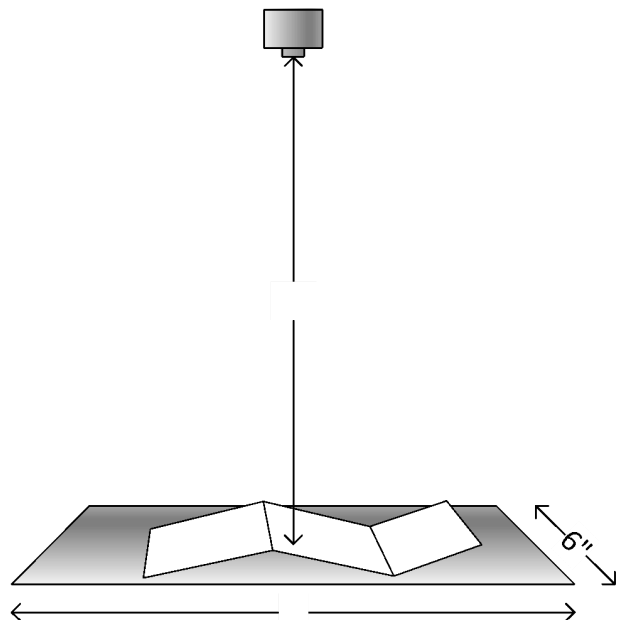
processing. The preferred image format to start image processing is the raw Bayer pattern mosaic from the camera, producing outputs in BMP file format. Algorithms can be implemented in any language but must be documented well enough to port to other programming languages like C and Java.

Composition of Team:
1 Electrical Engineer and 2 to 3 Computer Engineers

Skills Required:

- Illumination control
- Programming skills in any language
- Familiarity with UML
- Familiarity with writing "portable" pseudo-code.

Anticipated Best Outcome's Impact on Company's Business:
New algorithms developed under this project may be integrated into a new image processing library currently under development giving the company new image processing capabilities.

Broader Implications of the Best Outcome on the Company's Industry:
Until now, camera-based playslip reading has imposed several constraints on playslip design. The new image processing library under development is expected to eliminate those constraints and transform the way the Lottery industry processes documents.

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