

Adding InfraMarker Technologies to GPS Technologies leads to Effective Recovery of Facilities

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HIGHLIGHTS

- Retrieving facilities mapped with GPS technologies using GPS technology alone is time-consuming
- Adding magnetic location with an RFID tag on the facility makes it easier to retrieve facilities
- A scientific experiment reveals retrieval accuracy and time to recover reduce drastically when the three technologies are combined together

BACKGROUND

An article published in ArcNews (Spring 2012, p. 35) on the geospatial mapping of infrastructure elements in the Gulf Shores area led to increased interest in disaster recovery efforts. This article reported that using GPS technologies alone, it takes approximately 100 days to mark the 10,000 infrastructure elements located close to the beach in the cities of Gulf Shores and Orange Beach, Alabama. While a coordinate is provided by the GPS unit, the facility may be buried with sand or debris on top of it when a hurricane hits. Workers must dig to identify the desired facility. This led to a desire to identify more efficient technologies in order to facilitate quicker, more effective recovery.

The article triggered Mr. Bill Rushing, Vice President of Research at Berntsen International, Inc., to contact the authors (Geospatial Research and Applications Center, GRAC, www.auburn.edu/grac) and find out whether it is possible to use the InfraMarker technologies (combination of magnetic location and RFID) developed by Berntsen International, Inc., to resolve this problem. The InfraMarker technology uses the synergy of a permanent magnet for location and an RFID chip for identification. It is possible to program the RFID chip with

information fields about that specific element, differentiating one element from all the others in an area. The team worked together to create a scientific experiment where three methods - GPS alone, InfraMarker alone, and GPS & InfraMarker - were used to retrieve tags buried in a beach area in the city of Gulf Shores. Both accuracy in retrieving the tags and the time taken to retrieve them were recorded and compared.

METHODS

Students traveled to Gulf Shores, Alabama to perform the experiment in real-world conditions on the beach. GRAC recruited the students and workers to perform the experiment and provided them with the GPS units and other needed materials. Berntsen provided all the equipment and tags needed for the InfraMarker portion of the experiment.

The experiment asked students to retrieve five targets with differing technologies at their disposal. For the first test, teams were provided only a GPS unit with coordinates downloaded from an ArcGIS file to locate five buried targets. For the second test, participants were provided with a magnetic locator and an RFID reader to find five buried tags. For the last test, teams were given access to all the technologies (a GPS unit, a magnetic locator, and an RFID reader) to find five other buried tags. All targets were hidden at a similar distance from a set starting point at each site.

A total of 51 students performed the experiment participating in 17 teams. None of them had earlier experience in working with the technologies. They were provided a 15 minute training session and were provided 15 minutes to recover the five targets for each test. If the team had not located all the five targets within the 15 minutes, they were requested to proceed to the next test.

RESULTS

In the first test, using a GPS coordinate alone was a good starting point, but the margin for error and the inability to detect a target specifically made the process difficult. Students had to dig through the sand and hope their coordinate was accurate to limit the digging. Frequently, they missed locating a target even though it was very near the place where they dug.

In the second test, using only magnetic locator and RFID reader led students on a bit of a ‘wild goose chase.’ With no positioning information, students had to randomly search the test site to detect targets below the visible surface.

In the third test, when used in combination, the technologies nicely complemented each other. A GPS coordinate guided students to the correct general location. Then, the magnetic locator was used to identify the target below the surface. The RFID reader could then identify which specific target was under the ground without having to dig it up. It became clear that using these technologies in combination could be very beneficial in a post-disaster setting where time and accuracy of asset recovery are vital.

Each team found targets more quickly and accurately using the three technologies in combination than using either method in isolation. Students located 91% of the targets using the combined technologies, 39% of the targets using InfraMaker technology alone, and 19% of the targets using GPS alone. The time taken to retrieve a target was 2.51 minutes with the combined technologies, 10.47 minutes with InfraMarker technology alone, and 14.11 minutes with GPS alone. Students made the following statements about their experiences:

- “Helped the morale of the team - without it I would find another job”

- “All technology together is the best – market the combination as the most efficient means to find assets”
- “Combination was dynamite!”
- “Hardest to use alone was the InfraMarker – need GPS to generally locate the tags.”
- “Using only GPS doesn’t work – I could dig all day! I know I’m in the vicinity but can’t find it”
- “If only one technology is available, get GPS”

GRAC along with Berntsen International, Inc., is working with the local utilities in Baldwin county to conduct more experiments where actual facilities are marked using InfraMarker tags and position identified using GPS technologies. We look forward to sharing the results of these experiments in the future.

For more information, contact Dr. Chetan S. Sankar, COB Advisory Council Professor of Information Systems, Auburn University (e-mail: sankacs@auburn.edu) or Bill Rushing, Vice President of Research & Development, Berntsen International, Inc. (e-mail: brushing@berntsen.com).



RFID Reader



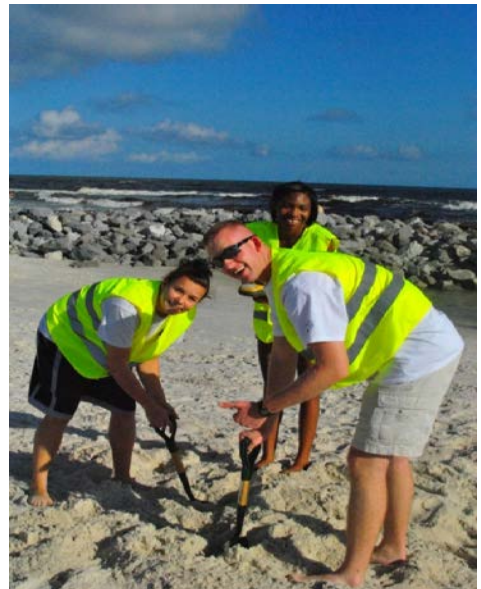
Topcon GPS Unit



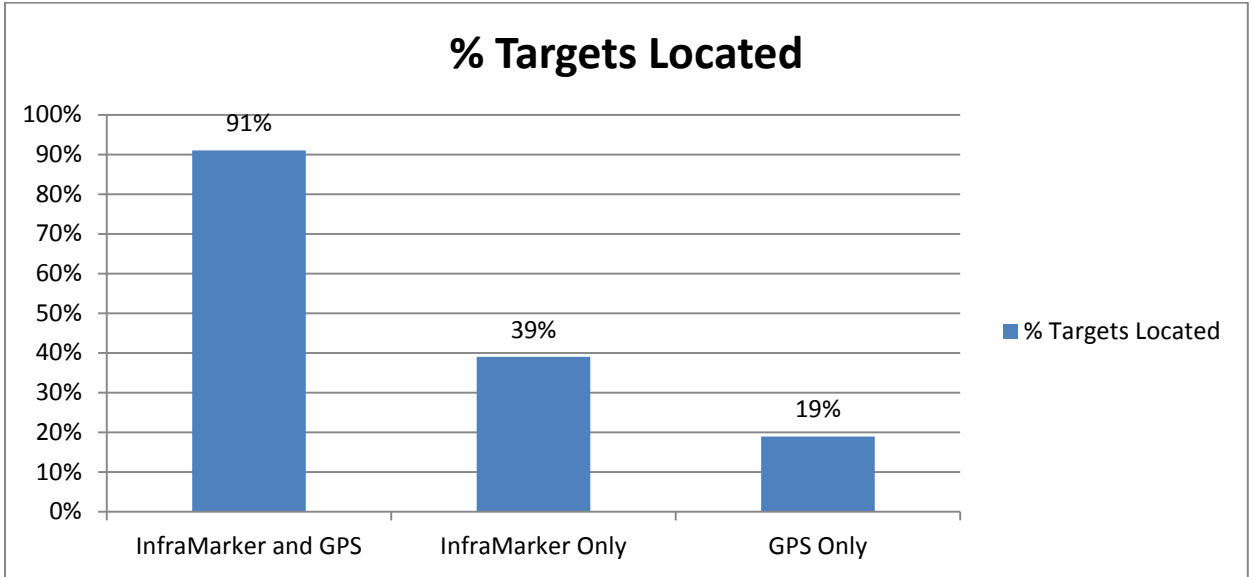
InfraMarker Tag



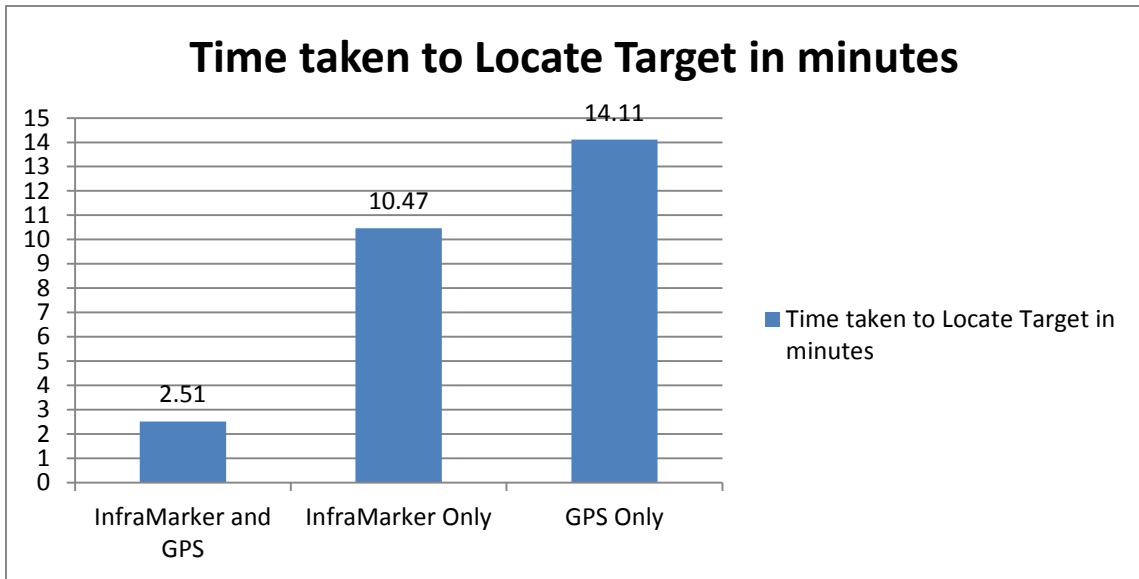
Students using magnetic locator and RFID technologies to locate a target



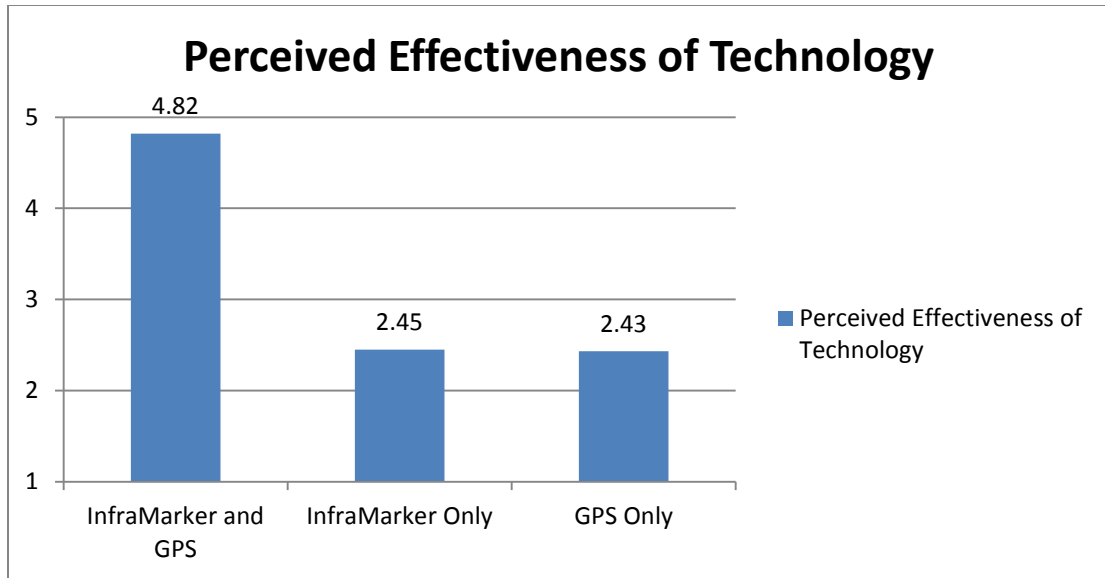
Students using GPS technology alone to locate a target



Percentage of Targets located with different technologies



Time taken to locate each target with different technologies



Perceived Effectiveness of Each Technology

(Scale: 1 – Strongly disagree; 3 – Neither Agree nor Disagree; 5 – Strongly Agree)