Application of Unmanned Aerial Vehicle Technology in Emergency Medical Situations

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Introduction

- One of the significant impacts on patient outcome in emergency medical situations is the response time taken for emergency medical services (EMS) to arrive at the scene.
- "Response time" is measured from the time EMS is notified by dispatch, to the team’s time of arrival, with the current average time in the US being 9.4 min.¹
- 11.2% of all response times are >12 min, but research suggests that a time of 6 min. is critical for sparing the life of a cardiac patient¹ and can improve survival outcome by 6.5%.¹
- Unmanned Aerial Vehicles (UAV) have the potential to medical technology and supplies to a patient in much shorter time, while the medical team is en route.
- Our study, considered Phase 1 of a multi-stage project, examined this possibility by applying the use of UAV to a mock emergency of a cardiac patient.

Objectives

- To equip a UAV with i-Phone carrying ECG technology and fly it a 100 yard distance to a mock emergency situation with a "bystander" and "patient."
- To have the bystander utilize appropriately apply the delivered ECG technology in order to obtain a valid recording of patient’s heart rate and rhythm.

Methods

- The ECG was an AliveCor Kardia model attached to an iPhone 5.
- Written instructions for a layperson to operate the ECG were included with the UAV. A summary of said instructions can be seen in Figure 1.
- The UAV model we selected is a Phantom 2 Vision, which was used because of its small size and weight (1160g).
- Our fully equipped DJI Phantom 2 Vision UAV, with the i-Phone 5 AliveCor ECG software mounted to the underside, is shown in Figure 2.
- Figure 3 shows our mock emergency situation: bystander applying i-Phone with AliveCor, delivered via UAV, to obtain an ECG reading of a cardiac patient.
- Figure 4 shows the ECG reading shown in Figure 3.

Results

- The total flight time for 100 yards across an open field was two minutes, or approximately 2.5 ft/sec.
- A chi-squared analysis of data (Table 1) showed a significant p-value (p<.01), proving that our UAV was successful in navigating faster than the national average time for emergency response. The national average time for emergency response is 9.4 minutes, which is significantly faster than the average of 11 minutes. This result suggests that UAV technology can significantly improve response times and potentially save lives.

Discussion

- Successful trials and data demonstrate that the UAV is capable of carrying the necessary equipment safely while maintaining short flight time.
- Because our p-value was .01 (<.05), we have proven that it was the UAV that allowed the ECG reading to be carried out in a manner that beats the national average time for emergency response.
- The ECG reading shown in Figure 4 shows a clear printout that could be evaluated by a medical professional, with a PQRST consistent with normal heart beat on a test subject.
- The UAV is capable of carrying the necessary equipment safely while maintaining short flight time.
- The video and audio systems on board can be utilized in the future to gather information from a patient as well as transmitting instructions from a receiving physician.
- It may be possible to utilize medical UAV technology in a military field situation.

Conclusion

- Unmanned Aerial Vehicles can significantly decrease the time needed for emergency medical response.
- This first phase of a multi-phase project provides incentive and justification to continue exploring UAV technology beyond a 12-Lead ECG.

Table 1. Statistical analysis. Df=1

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<tr>
<th>Standard time (minutes)</th>
<th>Observed time (minutes)</th>
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<td>9.4</td>
<td>2.5</td>
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