

# CSU East Bay Hack Day

## A University Hackathon to Combat Malaria and Zika with Drones

James Tandon, Mario Gumina, Nazzy Pakpour, Reza Akhavian  
California State University, East Bay, 25800 Carlos Bee Blvd., Hayward, CA 94542  
james.tandon@csueastbay.edu; nazzy.pakpour@csueastbay.edu; reza.akhavian@csueastbay.edu

### I. INTRODUCTION

Engineering taught in the context of an application is a strong motivator for students as they can understand the critical questions underlying new concepts. Fostering interest and creativity in students is essential for engaging them in the learning process and has been shown to increase the long-term retention of new information. The CSU East Bay Hack Day: Drones and Disease event was held in April 2016 to promote engineering education in the context of mosquito-borne illnesses, a relevant real-world problem. This hackathon had the participants work in groups of 2-8 students to implement a rapid prototype of a drone system to assist with mosquito control and/or surveillance over the course of twelve hours. The students were provided a series of flash talks—short presentations of about five minutes—to orient them to the basics of mosquito biology, drone programming, and project management. Students were then provided with a drone kit, sensor packages, and basic instructions for how to implement each part but were otherwise left to their own creativity. This scaffolded the students so that they could rapidly integrate their systems in any way they chose and allowed students with no previous programming experience to make meaningful contributions..

This paper will describe the preparation, recruitment of students, and advancement to execute a multidisciplinary hackathon for university students. Our results indicated that students who participated in the first CSU East Bay Hack Day had a 98% satisfaction rate, and that the majority “agreed” or “strongly agreed” that they learned more about engineering and biology by participating in the event. In addition, our theme and outreach efforts resulted in students from across multiple disciplines participating in the event.

### II. HACKATHONS

#### A. Fostering Creativity

The hackathon template calls for participants to spend 12 hours of intensive work to implement a project. At the end of the development period each group gives a 5 minute pitch to the audience about their project among which judges will choose the winner based on theme specific criteria [1]. A major goal in a university setting is to encourage students to learn new skills. In our hackathon, flash talks were given to orient the students to the control of mosquito-borne illness and also to basics of drone technology. As our participants came from a range of majors, with many having no prior engineering experience, an extensive set of tutorials were provided for assembling drones, building circuits for sensors, and programming systems.

#### B. Problem: Control and surveillance of mosquito that transmit disease

Every year diseases transmitted by mosquitoes kill an average of 725,000 people around the world [2]. The most deadly of these mosquito-borne illnesses is malaria, with 80% of the world’s population at risk of infection and approximately half a million deaths each year [3]. Infection by Zika virus, which causes microcephaly in newborn children, is another mosquito-borne illness that has accelerated in transmission over the last few years [4]. Control of mosquito populations involves the accurate and effective surveillance of populations coupled with the judicious delivery of control mechanisms. The latter being particularly important as most mosquito-borne illnesses occur in resource poor settings.

#### C. Solution: Drone Technology

Students were provided with drone kits and sensors with extensive tutorials in order to provide them with a foundation to develop their prototypes. Two types of drones were available: a quadcopter and a small car drone. Additionally, students had a set of ten types of sensors that they could integrate with their drones when implementing their proposed drone solution. Over two thousand different permutations were possible and each permutation could be applied to solve any number of particular problems. The tutorials provided for drone assembly and for individual sensor integration enabled students to concentrate on the final product and not get bogged down in the minute details for integrating a system.

### III. SUMMARY

While the hackathon framework falls outside of the normal course curriculum of a university, it is a valuable tool for fostering creativity and generating interest of students in STEM education. Though only a 12 hour intensive work period was allowed, students gained valuable experience working in teams as they learned new skills.

### IV. REFERENCES

- [1] M. Komssi and e. al., "What Are Hackathons For?," *IEEE Software*, vol. 32, no. 5, pp. 60-67, September 2015.
- [2] B. Gates, "The Deadliest Animal in the World," gatesnotes.com, 25 April 2014. [Online]. Available: <https://www.gatesnotes.com/Health/Most-Lethal-Animal-Mosquito-Week>. [Accessed 19 October 2016].
- [3] World Health Organization, "World Malaria Report 2015," World Health Organization, Geneva, Switzerland, 2015.
- [4] J. Mlakar, M. Korva, N. Tul, M. Popović, M. Poljšak-Prijatelj, J. Mraz, M. Kolenc, K. Resman Rus, T. Vesnaver Vipotnik, V. Fabjan Vodušek, A. Vizjak, J. Pižem and Petrove, "Zika Virus Associated with Microcephaly," *New England Journal of Medicine*, vol. 374, no. 10, pp. 951-958, 2016.

