Remote operated sensors either online or in the field of observations are limited to the time scales in interpolations of geographic events. This mainly owing to the design and implementation of the sensor systems. Many of the sensors that we use can last a long period of observation time, but cannot detect the event or event change in the time scale of hours or minutes, or even in a few days. Time scale is equally important to the spatial scale in designing the sensor and analyzing the spatial data to understand the geographic events. In this research, we compare and contrast the time scale sensitivities of some of the remote sensors first. Then, a built remote sensor with unmanned helicopter or UAV was applied to conduct two time sensitive or detail time scale studies. In these studies, the geographic events “what is happening?” or “what has happened?” were captured otherwise would not be recorded by any other meanings.

Spatial and temporal changes of parking lot land use during school days at SUNY – Buffalo State College were studied applying a low altitude flying sensor – unmanned helicopter. Shortage of on campus parking space during a school day is one of major problems for the universities in the United States, in particular for those urban campuses. In essence, this is a land use and land use change problem in a brief time period that is impacted by many factors. In this research, we applied the unmanned helicopter remote sensing to collect occupational land use changes of student parking lots during typical school days, such as Monday, Wednesday and Friday or Tuesday and Thursday. Spatial and temporal occupation models were visualized by hourly bases during a typical school day. The field collected student parking lot occupation data was statistically and geographically related to the university class offering time and location database.

The experiment and samplings were conducted in spring and fall semesters of 2014. The results show that the highest utilization rates of both student parking lots and classrooms occur in Tuesday and Thursday afternoons. By contrast, the parking lot competition was not very intense during the morning hours of school days. The imbalance of parking lot occupations is not only at different times and days, but also at different locations on campus. Large student parking lots are located in the west side of the campus, while most buildings of class offering are located on the east part of the campus. The only student parking lot at the east side of the campus (lot Y) is always full during the school days. Based on the results of this study, suggestions of effective on campus parking management were proposed.

The second sensor application study was to utilize unmanned helicopter sensor to analyze the spatial distributions and habitat conditions of invasive species - Fallopia japonica (Japanese Knotweed). The objectives of this research were to verify and confirm the distribution of Japanese knotweed as published online by the New York Department of Environmental
Conservation (DEC) – iMap and to identify the geographic areas of spreading and the local habitat conditions. In this research, we applied an unmanned helicopter with multiple sensors including digital camera, thermometer and relative humidity sensor to survey the patches of Japanese knotweed and its three-dimensional (3D) habitat conditions. The areas of each of the patch surveyed were delineated. To identify the local habitat conditions, the shade cover and distance to the nearest water body were analyzed by using traditional statistical methods. And the distributions of temperature and relative humidity were visualized in three-dimensional (3D) geographic space.

Both of these experiments demonstrate that 1) capture of brief time scale data is significant in studying the geographic events to understand what is happening; and 2) Time sensitive sensor building not only very useful to identify event locations, but also to enhance and validate event descriptions otherwise would not be possible. More strategies and methods are needed in geographic information researches in capturing and modeling the time sensitive geographic events.

*Keywords: time scale, unmanned helicopter remote sensing, spatial and temporal change*