

Enhanced Construction Site Monitoring with RTK-GPS Guided Unmanned Mobile Robot and Mapping API Integration

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The focus of this research lies at the intersection of two domains. The imperative for heightened safety measures within the construction industry and the increasing popularity for unmanned mobile monitoring systems. The construction sector is fraught with high risks compared to conventional workplaces, and as such requires meticulous safety protocols directed by the safety inspector. At the same time, unmanned ground vehicles (UGVs) have emerged as a compelling solution for reconnaissance missions avoiding issues related to labor cost and frequency inherent in manual procedures. Nevertheless, the dynamic nature of construction environments introduces a challenge for UGV path planning, due to constant shifting conditions. For addressing this, a mobile application engineered to provide real-time map updates by overlaying an image onto a mapping APPI (e.g., Google Maps). This digital twin generates a dynamic representation of the evolving terrain allowing UGV operators to delineate convenient paths using table PCs or smartphones. The discrete GPS information, encompassing latitude and longitude, is later fed into the UGV's controller. Moreover, the feasibility of employing a skid-steering vehicle equipped with a GPS sensor and an IMU to conduct safety inspections on construction sites is explored. This approach was successfully validated through practical implementations on a construction site and a soccer field, leveraging ground and satellite imagery, respectively. Quantitative assessment and analysis of error generation provide comprehensive insights into the efficacy of this technique.