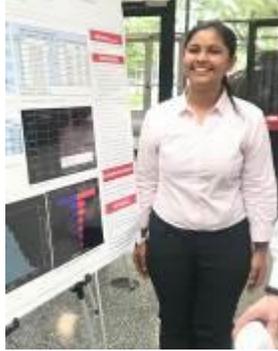


# Stochastic Modeling of Risk and Uncertainty in Project Management

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## **ABSTRACT**

Business executives often face the challenge of deciding what projects to invest in. They need to know which projects will maximize the chances of success. Many projects fail because the project cost estimates do not consider the risk and uncertainty (threats and opportunity). The estimates are often too optimistic and unrealistic.

HawkEye is a simulation software that was developed by Project Management Hawks (PMHawks). While the team PMHawks-2016 built HawkEye 1.0 that calculated Project Cost, NPV estimation and Portfolio Optimization, PMHawks-2017 added functionalities like Project Schedule, NPV and Decision Trees in HawkEye 2.0.

Our team Project Management Hawks-2018 (PMHawks-2018) is a group of four enthusiastic students. We have developed a modeling application HawkEye 3.0 to solve the above stated problems for our immersive summer research experience. While the previous versions of HawkEye worked in collaboration with MS Project and Visual Basic, HawkEye 3.0 has altogether scrapped the need of these two softwares by creating a model based on the programming language Python.

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## METHODS

HawkEye 1.0 developed a Monte Carlo engine and used Latin Hypercube sampling method to calculate the calculate Project Cost, NPV estimation and Portfolio Optimization. While HawkEye 2.0 worked in tandem with MS Project to calculate the Project Schedule and NPV.

HawkEye 3.0 has completely eliminated the use of MS Project and Visual Basic which has increased the usability of the software.

The user can calculate Project Cost, Schedule, and NPV as well as optimize Portfolios independently.

All the results are displayed in the form of interactive graphs and charts. The user can also get “tornado charts” to see the effect of the tasks on the complete project.

The user has the independence to use the software in Windows, Mac and Linux. The platform independence has further simplified the usage.

PMHawks-2018 has also implemented “Portfolio Optimization” which gives the user the best portfolio mix. In the previous versions only the deterministic method was used to select the portfolio whereas HawkEye 3.0 can calculate it stochastically.

It can also find total critical path time and the slack for the non- critical tasks. We have also included “Probabilistic branching”. The critical path can be calculated with risk as well as without risk in Project Schedule.

## CONCLUSIONS

- With the help of HawkEye Model we can generate more conservative project cost and schedule estimates. HawkEye 3.0 model will give the user better insights into project cost and schedule. Ultimately all of this will lead to more successful projects.
- The speed has improved significantly from the previous models, the performance has improved while HawkEye 3.0 can now perform more number of simulations.
- HawkEye 3.0 calculates the critical path and the float for each individual task for the Schedule that was not possible in the previous versions.
- When one accounts for the risk and uncertainty to do probabilistic analysis for NPV, the estimates are going to be more conservative and realistic. That would help one take more effective decisions. Thus, executives can have a better insight into the profitability and success of a project.
- When the NPV is positive, HawkEye 3.0 gives a percentage chance of the project being successful whereas the deterministic method does not give us this information.
- HawkEye 3.0 identifies the portfolio that has projects based on the highest NPVS vs the projects based on the highest BCRs. HawkEye 3.0 shows that selecting portfolios based on highest BCRs is a better method.

HawkEye 3.0 is a more robust, powerful and faster modelling software for stochastic modelling of Project Cost, Project Schedule, NPV and Portfolio Optimization.

