IV. Risks

Technology risks are those related to the physical platform we are developing for, or the software we develop.

Risk	Platform	Risk Type	Impact	Probability of Occurrence	Composite Risk Index
<u>Dramatic failure</u> affecting all portions of a Quanmax, eliminating the ability for it to be used	Quanmax	Complete Hardware Failure	Medium (3): difficult and expensive to replace, but doable	2: Will be in a harsher than normal environment	6
<u>Dramatic failure</u> affecting all portions of a mobile mote, eliminating the ability for it to be used	Mobile Mote	Complete Hardware Failure	Very Low (1): very easy to replace with any other compatible mote	4: will be mobile in a harsh environment	4
<u>Dramatic failure</u> affecting all portions of an infrastructure mote, eliminating the ability for it to be used	Infrastructure Mote	Complete Hardware Failure	Low (2): relatively easy to replace with a new mote	3: will be in a harsher than normal environment, fragile	6
<u>Dramatic failure</u> affecting all portions of a server, eliminating the ability for it to be used	Server	Complete Hardware Failure	High (4): hard to replace	2: old hardware	8
Failure of a wireless communications device, affecting only networking	Mote: wireless	Partial Hardware failure: communications	Low (2): easy to replace with any other compatible mote	4: will be mobile in a harsh environment	8
Failure of USB cable or interface devices, affecting only networking	Mote/Quanmax:USB	Partial Hardware failure: communications	Low (2): easy to replace with any other compatible mote/quanmax	2: not much movement, but harsh environment	4
Failure of Cat-5 wiring or interface devices, affecting only networking	Quanmax/switch:Cat-5	Partial Hardware failure: communications	Low (2): easy to replace with any other compatible quanmax/switch, or new wiring	2: not much movement, but harsh environment	4
Failure of the internet/network communication between Edgar Mine and the School of Mines	internet	Partial Hardware failure: communications	High (4): easy to replace with any other compatible mote	1: low	4
SOFTWARE					
OS failure on	Quanmax:	Complete Software	Low (2):	1	2

Quanmax	Debian	failure: OS	requires physical visit, but fixable		
Database failure on Quanmax	Quanmax: MySQL	Partial software failure: MySQL	Very Low (1): requires remote connection, fixable	3	3
Network failure on Quanmax	Quanmax: Debian-networking	Partial software failure: Debian networking	Low (2): requires physical visit, but fixable	1	2
Program failure on Quanmax	Quanmax: user-program	Partial software failure: user-program	Very Low(1): require remote connection, fixable	4	4
Program failure on mobile mote (failure to send id)	Mobile mote: software	Software failure	Low(2): requires physical visit, fixable	3	6
Program failure on infrastructure mote (failure to receive mobile mote signals)	Infrastructure mote: software	Partial software failure: infrastructure mote networking/software	Low(2): requires remote connection, fixable	3	6
Program failure on infrastructure mote (failure to sensor data)	Infrastructure mote: software	Partial software failure: infrastructure mote sensor software	Low(2): requires remote connection, fixable	3	6
Program failure on infrastructure mote (failure to transmit data)	Infrastructure mote: software	Partial software failure: infrastructure mote networking/software	Low(2): requires remote connection, fixable	3	6
Apache failure	web server thor.mines.edu:software	Partial software failure: server software	medium(3): requires remote connection, admin rights	1	3
MySQL failure, global database	server modi.mines.edu: software	Partial software failure: server software	Low(2): requires remote connection, fixable	3	6
Webapp	server thor.mines.edu: software	Partial software failure: server software	Low(2): requires remote connection, fixable	3	6

Most of the technological risks can only be reduced through careful handling of equipment, good coding, and repeated testing.

Skill risks include risks associated with learning new languages, and the impact that incorrect understanding of necessary concepts would have on the project objectives.

Skill	Point of Use	Difficulty	Impact	Significance
Perl/python	Quanmax, servers	low (2)	low (2)	4
MySQL	Quanmax, servers,	low (1)	high (4)	4

tinyOS	Motes	high (5)	high (5)	25
nesC	Motes	high (5)	high (5)	25
java	Quanmax, servers	medium (3)	high (4)	12
web-language	servers	medium-high (4)	high (4)	16

Other risks include unexpected hindrances to project goals, affecting either the entire environment or the project team.

Risk	Location	Type	Impact	Probability	Risk Index
Mine Closure	Edgar Mine	Physical Situation	High (3)	Low (1)	3
Mine Segment Collapse	Edgar Mine	Physical Hazard	High (3)	Low (1)	3
Mine Segment Fire	Edgar Mine	Physical Hazard	High (3)	Low (1)	3
Mine Segment Flooding	Edgar Mine	Physical Hazard	High (3)	Low (1)	3
Mine segment moisture beyond acceptable levels	Edgar Mine	Physical Situation	Medium (2)	Low (1)	2
Mine segment temperature beyond acceptable levels	Edgar Mine	Physical Situation	Medium (2)	Low (1)	2
Dust beyond acceptable levels	Edgar Mine	Physical Situation	Medium (2)	Medium (2)	4
Access to mine via car on roads	Idaho Springs/highways	Physical Situation	Low (1)	Low (1)	1
Lack of equipment	-	Physical Situation	High (4)	Low (1)	4
Team member death	Probably Edgar Mine	@#$@3	Really High (5)	Low (1)	5
Rebreather	Edgar Mine	@#$R%# YT#$)%*, @#$@,)(%^$, !@#$$#@)@#!!!	Really High (5)	Low (1)	5
Internal team friction	-	Social conditions	Medium (2)	some-what high (3)	6

Unfortunately, the vast majority of other risks cannot be predicted, reduced or eliminated, excluding creating sturdier housing for project equipment.