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Scanning systems

Abstract

The present application is directed toward cargo scanning systems having scanners, each arranged to scan a respective object and generate a set of scan data, processors arranged to process each set of scan data to determine whether it meets a predetermined threat condition, workstations, and data management system arranged to direct data that meets the threat condition to one of the workstations for analysis.

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References Cited

U.S. PATENT DOCUMENTS

Patent No.	Issued Date	Patentee Name	U.S. Cl.	CPC
2952790	12/1959	Steen	N/A	N/A
3146349	12/1963	Jordan	N/A	N/A
3239706	12/1965	Farrell	N/A	N/A
3458026	12/1968	Lauzon	N/A	N/A
3485339	12/1968	Miller	N/A	N/A
3768645	12/1972	Conway	N/A	N/A
3955678	12/1975	Moyer	N/A	N/A
3980889	12/1975	Haas	N/A	N/A
4057725	12/1976	Wagner	N/A	N/A
4105922	12/1977	Lambert	N/A	N/A
4228353	12/1979	Johnson	N/A	N/A
4259721	12/1980	Kuznia	N/A	N/A
4266425	12/1980	Allport	N/A	N/A
4274005	12/1980	Yamamura	N/A	N/A
4340816	12/1981	Schott	N/A	N/A
4352021	12/1981	Boyd	N/A	N/A
4366382	12/1981	Kotowski	N/A	N/A
4468802	12/1983	Friedel	N/A	N/A
4626688	12/1985	Barnes	N/A	N/A
4672649	12/1986	Rutt	N/A	N/A
4675890	12/1986	Plessis	N/A	N/A
4709382	12/1986	Sones	N/A	N/A
4817123	12/1988	Sones	N/A	N/A
RE32961	12/1988	Wagner	N/A	N/A
4866439	12/1988	Kraus	N/A	N/A
4866745	12/1988	Akai	N/A	N/A
4868856	12/1988	Frith	N/A	N/A
4872188	12/1988	Lauro	N/A	N/A
4887604	12/1988	Shefer	N/A	N/A

4979137	12/1989	Gerstenfeld	N/A	N/A
4987584	12/1990	Doenges	N/A	N/A
4991708	12/1990	Francioni	N/A	N/A
5033106	12/1990	Kita	N/A	N/A
5086300	12/1991	Ash More	N/A	N/A
5092451	12/1991	Jones	N/A	N/A
5097939	12/1991	Shanklin	N/A	N/A
5144191	12/1991	Jones	N/A	N/A
5182764	12/1992	Peschmann	N/A	N/A
5221843	12/1992	Alvarez	N/A	N/A
5243693	12/1992	Maron	N/A	N/A
5247556	12/1992	Eckert	N/A	N/A
5247561	12/1992	Kotowski	N/A	N/A
5259014	12/1992	Brettschneider	N/A	N/A
5272627	12/1992	Maschhoff	N/A	N/A
5313511	12/1993	Annis	N/A	N/A
5319547	12/1993	Krug	N/A	N/A
5341916	12/1993	Doane	N/A	N/A
5367552	12/1993	Peschmann	N/A	N/A
5410156	12/1994	Miller	N/A	N/A
5412702	12/1994	Sata	N/A	N/A
5467377	12/1994	Dawson	N/A	N/A
5490196	12/1995	Rudich	N/A	N/A
5490218	12/1995	Krug	N/A	N/A
5505291	12/1995	Huang	N/A	N/A
5511104	12/1995	Mueller	N/A	N/A
5548123	12/1995	Perez-Mendez	N/A	N/A
5557108	12/1995	Tumer	N/A	N/A
5590057	12/1995	Fletcher	N/A	N/A
5600303	12/1996	Husseiny	N/A	N/A
5600700	12/1996	Krug	N/A	N/A
5604778	12/1996	Polacin	N/A	N/A
5606167	12/1996	Miller	N/A	N/A
5633907	12/1996	Gravelle	N/A	N/A
5634551	12/1996	Francioni	N/A	N/A
5642393	12/1996	Krug	N/A	N/A
5660549	12/1996	Witt	N/A	N/A
5661774	12/1996	Gordon	N/A	N/A
5689541	12/1996	Schardt	N/A	N/A
5712926	12/1997	Eberhard	N/A	N/A
5738202	12/1997	Ydoate	N/A	N/A
5764683	12/1997	Swift	N/A	N/A
5796802	12/1997	Gordon	N/A	N/A
5818897	12/1997	Gordon	N/A	N/A
5838758	12/1997	Krug	N/A	N/A
5841831	12/1997	Hell	N/A	N/A
5859891	12/1998	Hibbard	N/A	N/A
5870449	12/1998	Lee	N/A	N/A
5881122	12/1998	Crawford	N/A	N/A
5882206	12/1998	Gillio	N/A	N/A

5887047	12/1998	Bailey	N/A	N/A
5901198	12/1998	Crawford	N/A	N/A
5903623	12/1998	Swift	N/A	N/A
5905806	12/1998	Eberhard	N/A	N/A
5909477	12/1998	Crawford	N/A	N/A
5910973	12/1998	Grodzins	N/A	N/A
5930326	12/1998	Rothschild	N/A	N/A
5949842	12/1998	Schafer	N/A	N/A
5963211	12/1998	Oikawa	N/A	N/A
5966422	12/1998	Dafni	N/A	N/A
5974111	12/1998	Krug	N/A	N/A
5982843	12/1998	Bailey	N/A	N/A
5987097	12/1998	Salasoo	N/A	N/A
6018562	12/1999	Willson	N/A	N/A
6021174	12/1999	Campbell	N/A	N/A
6026143	12/1999	Simanovsky	N/A	N/A
6026171	12/1999	Hiraoglu	N/A	N/A
6035014	12/1999	Hiraoglu	N/A	N/A
6037597	12/1999	Karavolos	N/A	N/A
6044353	12/1999	Pugliese	N/A	N/A
6067366	12/1999	Simanovsky	N/A	N/A
6073751	12/1999	Worzischek	N/A	N/A
6075871	12/1999	Simanovsky	N/A	N/A
6076400	12/1999	Bechwati	N/A	N/A
6078642	12/1999	Simanovsky	N/A	N/A
6088423	12/1999	Krug	N/A	N/A
6091795	12/1999	Schafer	N/A	N/A
6108396	12/1999	Bechwati	N/A	N/A
6111974	12/1999	Hiraoglu	N/A	N/A
6118852	12/1999	Rogers	N/A	N/A
6122343	12/1999	Pidcock	N/A	N/A
6128365	12/1999	Bechwati	N/A	N/A
6137895	12/1999	Al-Sheikh	N/A	N/A
6149592	12/1999	Yanof	N/A	N/A
6163591	12/1999	Benjamin	N/A	N/A
6181765	12/2000	Sribar	N/A	N/A
6183139	12/2000	Solomon	N/A	N/A
6185272	12/2000	Hiraoglu	N/A	N/A
6188745	12/2000	Gordon	N/A	N/A
6195444	12/2000	Simanovsky	N/A	N/A
6216540	12/2000	Nelson	N/A	N/A
6218943	12/2000	Ellenbogen	N/A	N/A
6236709	12/2000	Perry	N/A	N/A
6246320	12/2000	Monroe	N/A	N/A
6252929	12/2000	Swift	N/A	N/A
6256404	12/2000	Gordon	N/A	N/A
6269142	12/2000	Smith	N/A	N/A
6272230	12/2000	Hiraoglu	N/A	N/A
6292533	12/2000	Swift	N/A	N/A
6301327	12/2000	Martens	N/A	N/A

6304629	12/2000	Conway	N/A	N/A
6317509	12/2000	Simanovsky	N/A	N/A
6324243	12/2000	Edic	N/A	N/A
6324249	12/2000	Fazzio	N/A	N/A
6345113	12/2001	Crawford	N/A	N/A
6370222	12/2001	Cornick	N/A	N/A
6418189	12/2001	Schafer	N/A	N/A
6429578	12/2001	Danielsson	N/A	N/A
6430255	12/2001	Fenkart	N/A	N/A
6431344	12/2001	Emmermann	N/A	N/A
6445765	12/2001	Frank	N/A	N/A
6446782	12/2001	Patrick	N/A	N/A
6459755	12/2001	Li	N/A	N/A
6459761	12/2001	Grodzins	N/A	N/A
6459764	12/2001	Chalmers	N/A	N/A
6507025	12/2002	Verbinski	N/A	N/A
6542580	12/2002	Carver	N/A	N/A
6546072	12/2002	Chalmers	N/A	N/A
6549683	12/2002	Bergeron	N/A	N/A
6552346	12/2002	Verbinski	N/A	N/A
6556653	12/2002	Hussein	N/A	N/A
6563906	12/2002	Hussein	N/A	N/A
6590956	12/2002	Fenkart	N/A	N/A
6618466	12/2002	Ning	N/A	N/A
6629593	12/2002	Zeitler	N/A	N/A
6647091	12/2002	Fenkart	N/A	N/A
6647094	12/2002	Harding	N/A	N/A
6647095	12/2002	Hsieh	N/A	N/A
6687333	12/2003	Carroll	N/A	N/A
6690766	12/2003	Kresse	N/A	N/A
6707879	12/2003	McClelland	N/A	N/A
6715533	12/2003	Kresse	N/A	N/A
6721387	12/2003	Naidu	N/A	N/A
6721391	12/2003	McClelland	N/A	N/A
6735271	12/2003	Rand	N/A	N/A
6737652	12/2003	Lanza	N/A	N/A
6748043	12/2003	Dobbs	N/A	N/A
6754298	12/2003	Fessler	N/A	N/A
6760407	12/2003	Price	N/A	N/A
6770884	12/2003	Bryman	N/A	N/A
6775348	12/2003	Hoffman	N/A	N/A
6788761	12/2003	Bijjani	N/A	N/A
6812426	12/2003	Kotowski	N/A	N/A
6813374	12/2003	Karimi	N/A	N/A
6816571	12/2003	Bijjani	N/A	N/A
6827265	12/2003	Knowles	N/A	N/A
6829585	12/2003	Grewal	N/A	N/A
6830185	12/2003	Tsikos	N/A	N/A
6837432	12/2004	Tsikos	N/A	N/A
6856667	12/2004	Ellenbogen	N/A	N/A

6859514	12/2004	Hoffman	N/A	N/A
6899540	12/2004	Neiderman	N/A	N/A
6901135	12/2004	Fox	N/A	N/A
6901346	12/2004	Tracy	N/A	N/A
6906329	12/2004	Bryman	N/A	N/A
6907101	12/2004	Hoffman	N/A	N/A
6922455	12/2004	Jurczyk	N/A	N/A
6922460	12/2004	Skatter	N/A	N/A
6922461	12/2004	Kang	N/A	N/A
6928141	12/2004	Carver	N/A	N/A
6933504	12/2004	Hoffman	N/A	N/A
6934354	12/2004	Hoffman	N/A	N/A
6940071	12/2004	Ramsden	N/A	N/A
6944264	12/2004	Bijjani	N/A	N/A
6947517	12/2004	Hoffman	N/A	N/A
6950492	12/2004	Besson	N/A	N/A
6950493	12/2004	Besson	N/A	N/A
6952163	12/2004	Huey	N/A	N/A
6953935	12/2004	Hoffman	N/A	N/A
6957913	12/2004	Renkart	N/A	N/A
6962289	12/2004	Vatan	N/A	N/A
6968030	12/2004	Hoffman	N/A	N/A
6968034	12/2004	Ellenbogen	N/A	N/A
6971577	12/2004	Tsikos	N/A	N/A
6973158	12/2004	Besson	N/A	N/A
6975698	12/2004	Katcha	N/A	N/A
6978936	12/2004	Tsikos	N/A	N/A
6980627	12/2004	Qiu	N/A	N/A
6990171	12/2005	Toth	N/A	N/A
6990172	12/2005	Toth	N/A	N/A
6991371	12/2005	Georgeson	N/A	N/A
6993115	12/2005	McGuire	N/A	N/A
6996209	12/2005	Marek	N/A	N/A
7010083	12/2005	Hoffman	N/A	N/A
7016459	12/2005	Ellenbogen	N/A	N/A
7020241	12/2005	Beneke	N/A	N/A
7020242	12/2005	Ellenbogen	N/A	N/A
7023956	12/2005	Heaton	N/A	N/A
7023957	12/2005	Bijjani	N/A	N/A
7027553	12/2005	Dunham	N/A	N/A
7027554	12/2005	Gaultier	N/A	N/A
7031430	12/2005	Kaucic	N/A	N/A
7031434	12/2005	Saunders	N/A	N/A
7034313	12/2005	Hoffman	N/A	N/A
7039154	12/2005	Ellenbogen	N/A	N/A
7042975	12/2005	Heuscher	N/A	N/A
7045787	12/2005	Verbinski	N/A	N/A
7046756	12/2005	Hoffman	N/A	N/A
7046761	12/2005	Ellenbogen	N/A	N/A
7050536	12/2005	Fenkart	N/A	N/A

7054408	12/2005	Jiang	N/A	N/A
7062009	12/2005	Karimi	N/A	N/A
7062011	12/2005	Tybinkowski	N/A	N/A
7062074	12/2005	Beneke	N/A	N/A
7064334	12/2005	Hoffman	N/A	N/A
7065175	12/2005	Green	N/A	N/A
7065179	12/2005	Block	N/A	N/A
7068749	12/2005	Kollegal	N/A	N/A
7068750	12/2005	Toth	N/A	N/A
7068751	12/2005	Toth	N/A	N/A
7072434	12/2005	Tybinkowski	N/A	N/A
7076029	12/2005	Toth	N/A	N/A
7078699	12/2005	Seppi	N/A	N/A
7081628	12/2005	Granfors	N/A	N/A
7084404	12/2005	Hoffman	N/A	N/A
7087902	12/2005	Wang	N/A	N/A
7088799	12/2005	Hoffman	N/A	N/A
7090133	12/2005	Zhu	N/A	N/A
7092481	12/2005	Hoffman	N/A	N/A
7092485	12/2005	Kravis	N/A	N/A
7103137	12/2005	Seppi	N/A	N/A
7110488	12/2005	Katcha	N/A	N/A
7112797	12/2005	Hoge	N/A	N/A
7116749	12/2005	Besson	N/A	N/A
7116751	12/2005	Ellenbogen	N/A	N/A
7119553	12/2005	Yang	N/A	N/A
7123681	12/2005	Ellenbogen	N/A	N/A
7127027	12/2005	Hoffman	N/A	N/A
7130374	12/2005	Jacobs	N/A	N/A
7133491	12/2005	Bernardi	N/A	N/A
7136450	12/2005	Ying	N/A	N/A
7136451	12/2005	Naidu	N/A	N/A
7139367	12/2005	Le	N/A	N/A
7139406	12/2005	McClelland	N/A	N/A
7142629	12/2005	Edic	N/A	N/A
7149278	12/2005	Arenson	N/A	N/A
7149339	12/2005	Veneruso	N/A	N/A
7155812	12/2006	Peterson	N/A	N/A
7158611	12/2006	Heismann	N/A	N/A
7164747	12/2006	Ellenbogen	N/A	N/A
7164750	12/2006	Nabors	N/A	N/A
7166458	12/2006	Ballerstadt	N/A	N/A
7166844	12/2006	Gormley	N/A	N/A
7167539	12/2006	Hoffman	N/A	N/A
7173998	12/2006	Hoffman	N/A	N/A
7177387	12/2006	Yasunaga	N/A	N/A
7177391	12/2006	Chapin	N/A	N/A
7190757	12/2006	Ying	N/A	N/A
7192031	12/2006	Dunham	N/A	N/A
7197113	12/2006	Katcha	N/A	N/A

7197172	12/2006	Naidu	N/A	N/A
7203629	12/2006	Oezis	N/A	N/A
7204125	12/2006	Fine	N/A	N/A
7206379	12/2006	Lemaitre	N/A	N/A
7212113	12/2006	Zanovitch	N/A	N/A
7215731	12/2006	Basu	N/A	N/A
7215738	12/2006	Muenchau	N/A	N/A
7218700	12/2006	Huber	N/A	N/A
7218704	12/2006	Adams	N/A	N/A
7224763	12/2006	Naidu	N/A	N/A
7224765	12/2006	Ellenbogen	N/A	N/A
7224766	12/2006	Jiang	N/A	N/A
7224769	12/2006	Turner	N/A	N/A
7233640	12/2006	Ikhlef	N/A	N/A
7236564	12/2006	Hopkins	N/A	N/A
7238945	12/2006	Hoffman	N/A	N/A
7247856	12/2006	Hoge	N/A	N/A
7251310	12/2006	Smith	N/A	N/A
7257189	12/2006	Modica	N/A	N/A
7260170	12/2006	Arenson	N/A	N/A
7260171	12/2006	Arenson	N/A	N/A
7260172	12/2006	Arenson	N/A	N/A
7260173	12/2006	Wakayama	N/A	N/A
7260174	12/2006	Hoffman	N/A	N/A
7260182	12/2006	Toth	N/A	N/A
7263160	12/2006	Schlomka	N/A	N/A
7266180	12/2006	Saunders	N/A	N/A
7272429	12/2006	Walker	N/A	N/A
7274767	12/2006	Clayton	N/A	N/A
7277577	12/2006	Ying	N/A	N/A
7279120	12/2006	Cheng	N/A	N/A
7280631	12/2006	De	N/A	N/A
7282727	12/2006	Retsky	N/A	N/A
7283604	12/2006	De	N/A	N/A
7283609	12/2006	Possin	N/A	N/A
7295019	12/2006	Yang	N/A	N/A
7295651	12/2006	Delgado	N/A	N/A
7298812	12/2006	Tkaczyk	N/A	N/A
7302083	12/2006	Larson	N/A	N/A
7308073	12/2006	Tkaczyk	N/A	N/A
7308074	12/2006	Jiang	N/A	N/A
7308077	12/2006	Bijjani	N/A	N/A
7317195	12/2007	Eikman	N/A	N/A
7317390	12/2007	Huey	N/A	N/A
7319737	12/2007	Singh	N/A	N/A
7322745	12/2007	Agrawal	N/A	N/A
7324625	12/2007	Eilbert	N/A	N/A
7327853	12/2007	Ying	N/A	N/A
7330527	12/2007	Hoffman	N/A	N/A
7330535	12/2007	Arenson	N/A	N/A

7333587	12/2007	De	N/A	N/A
7333588	12/2007	Mistretta	N/A	N/A
7333589	12/2007	Ellenbogen	N/A	N/A
7335887	12/2007	Verbinski	N/A	N/A
7336769	12/2007	Arenson	N/A	N/A
7349525	12/2007	Morton	N/A	N/A
7397891	12/2007	Johnson	N/A	N/A
7430479	12/2007	Holslin	N/A	N/A
7440543	12/2007	Morton	N/A	N/A
7492855	12/2008	Hopkins	N/A	N/A
7505557	12/2008	Modica	N/A	N/A
7512215	12/2008	Morton	N/A	N/A
7564939	12/2008	Morton	N/A	N/A
7580505	12/2008	Kang	N/A	N/A
7684538	12/2009	Morton	N/A	N/A
7734066	12/2009	Delia	N/A	N/A
7734102	12/2009	Bergeron	N/A	N/A
7817775	12/2009	Kang	N/A	N/A
7903783	12/2010	Modica	N/A	N/A
7973697	12/2010	Reilly	N/A	N/A
8173970	12/2011	Inbar	N/A	N/A
8243167	12/2011	Liang	N/A	N/A
8304740	12/2011	Frank	N/A	N/A
8472583	12/2012	Star-Lack	N/A	N/A
9111331	12/2014	Parikh	N/A	N/A
9632206	12/2016	Parikh	N/A	N/A
2001/0016684	12/2000	Shahidi	N/A	N/A
2001/0022346	12/2000	Katagami	N/A	N/A
2001/0033635	12/2000	Kuwabara	N/A	N/A
2002/0031202	12/2001	Callerame	N/A	N/A
2002/0038753	12/2001	Ursu	N/A	N/A
2002/0045152	12/2001	Viscardi	N/A	N/A
2002/0094064	12/2001	Zhou	N/A	N/A
2002/0172324	12/2001	Ellengogen	N/A	N/A
2002/0176531	12/2001	McClelland	N/A	N/A
2003/0021377	12/2002	Turner	N/A	N/A
2003/0023592	12/2002	Modica	N/A	N/A
2003/0031352	12/2002	Nelson	N/A	N/A
2003/0085163	12/2002	Chan	N/A	N/A
2003/0191557	12/2002	Takehara	N/A	N/A
2004/0041724	12/2003	Levitan	N/A	N/A
2004/0073808	12/2003	Smith	N/A	N/A
2004/0080315	12/2003	Beevor	N/A	N/A
2004/0086078	12/2003	Adams	N/A	N/A
2004/0101098	12/2003	Bijjani	N/A	N/A
2004/0120454	12/2003	Ellenbogen	N/A	N/A
2004/0126015	12/2003	Hadell	N/A	N/A
2004/0140924	12/2003	Keller	N/A	N/A
2004/0202154	12/2003	Aklepi	N/A	N/A
2004/0212492	12/2003	Boesch	N/A	N/A

2004/0212499	12/2003	Bohinc	N/A	N/A
2004/0213378	12/2003	Zhou	N/A	N/A
2004/0213379	12/2003	Bittl	N/A	N/A
2004/0232054	12/2003	Brown	N/A	N/A
2004/0251415	12/2003	Verbinski	N/A	N/A
2004/0252024	12/2003	Huey	N/A	N/A
2004/0252807	12/2003	Skatter	N/A	N/A
2004/0258198	12/2003	Carver	N/A	N/A
2004/0258305	12/2003	Burnham	N/A	N/A
2004/0263379	12/2003	Keller	N/A	N/A
2005/0008119	12/2004	McClelland	N/A	N/A
2005/0024199	12/2004	Huey	N/A	N/A
2005/0031075	12/2004	Hopkins	N/A	N/A
2005/0031076	12/2004	McClelland	N/A	N/A
2005/0053189	12/2004	Gohno	N/A	N/A
2005/0064922	12/2004	Owens	N/A	N/A
2005/0105682	12/2004	Heumann	N/A	N/A
2005/0110672	12/2004	Cardiasmenos	N/A	N/A
2005/0111610	12/2004	Deman	N/A	N/A
2005/0117700	12/2004	Peschmann	N/A	N/A
2005/0156734	12/2004	Zerwekh	N/A	N/A
2005/0157844	12/2004	Bernardi	N/A	N/A
2005/0157925	12/2004	Lorenz	N/A	N/A
2005/0169421	12/2004	Muenchau	N/A	N/A
2005/0198226	12/2004	Delia	N/A	N/A
2005/0226364	12/2004	Bernard	N/A	N/A
2005/0249416	12/2004	Leue	N/A	N/A
2005/0251397	12/2004	Zanovitch	N/A	N/A
2005/0281390	12/2004	Johnson	N/A	N/A
2006/0018428	12/2005	Li	N/A	N/A
2006/0045323	12/2005	Ateya	N/A	N/A
2006/0066469	12/2005	Foote	N/A	N/A
2006/0086794	12/2005	Knowles	N/A	N/A
2006/0113163	12/2005	Hu	N/A	N/A
2006/0115044	12/2005	Wu	N/A	N/A
2006/0115109	12/2005	Whitson	N/A	N/A
2006/0138331	12/2005	Guillebaud	N/A	N/A
2006/0220851	12/2005	Wisherd	N/A	N/A
2006/0257005	12/2005	Bergeron	N/A	N/A
2006/0273259	12/2005	Li	N/A	N/A
2006/0274916	12/2005	Chan	N/A	N/A
2007/0003003	12/2006	Seppi	N/A	N/A
2007/0083414	12/2006	Krohn	N/A	N/A
2007/0096030	12/2006	Li	N/A	N/A
2007/0110215	12/2006	Hu	N/A	N/A
2007/0133740	12/2006	Kang	N/A	N/A
2007/0165777	12/2006	Anwar	N/A	N/A
2007/0172024	12/2006	Morton	N/A	N/A
2007/0183568	12/2006	Kang	N/A	N/A
2007/0194909	12/2006	Garfield	N/A	N/A

2007/0195994	12/2006	McClelland	N/A	N/A
2007/0280416	12/2006	Bendahan	N/A	N/A
2007/0280502	12/2006	Paresi	N/A	N/A
2008/0023631	12/2007	Majors	N/A	N/A
2008/0044801	12/2007	Modica	N/A	N/A
2008/0056432	12/2007	Pack	N/A	N/A
2008/0056435	12/2007	Basu	N/A	N/A
2008/0075230	12/2007	Oreper	N/A	N/A
2008/0111693	12/2007	Johnson	N/A	N/A
2008/0143545	12/2007	King	N/A	N/A
2008/0198967	12/2007	Connelly	N/A	N/A
2008/0260097	12/2007	Anwar	N/A	N/A
2009/0034790	12/2008	Song	N/A	N/A
2009/0161816	12/2008	Deman	N/A	N/A
2009/0174554	12/2008	Bergeron	N/A	N/A
2009/0236531	12/2008	Frank	N/A	N/A
2009/0283690	12/2008	Bendahan	N/A	N/A
2009/0323894	12/2008	Hu	N/A	N/A
2010/0030370	12/2009	King	N/A	N/A
2010/0161504	12/2009	Casey	N/A	N/A
2011/0060426	12/2010	Morton	N/A	N/A
2011/0172972	12/2010	Gudmundson	N/A	N/A
2011/0216881	12/2010	Modica	N/A	N/A
2012/0093367	12/2011	Gudmundson	N/A	N/A
2012/0105267	12/2011	Delia	N/A	N/A
2012/0300902	12/2011	Modica	N/A	N/A
2015/0325010	12/2014	Bedford	N/A	N/A

FOREIGN PATENT DOCUMENTS

Patent No.	**Application Date**	**Country**	**CPC**
101022649	12/2006	CN	N/A
101303317	12/2007	CN	N/A
101446910	12/2008	CN	N/A
2729353	12/1978	DE	N/A
3214910	12/1982	DE	N/A
0176314	12/1985	EP	N/A
0432568	12/1990	EP	N/A
0531993	12/1992	EP	N/A
0584871	12/1993	EP	N/A
0924742	12/1998	EP	N/A
0930046	12/1998	EP	N/A
0963925	12/1998	EP	N/A
1277439	12/2002	EP	N/A
1374776	12/2003	EP	N/A
2270547	12/2010	EP	N/A
2328280	12/1976	FR	N/A
1497396	12/1977	GB	N/A
1526041	12/1977	GB	N/A
2015245	12/1978	GB	N/A
2089109	12/1981	GB	N/A

2212903	12/1988	GB	N/A
2337032	12/1998	GB	N/A
2404431	12/2004	GB	N/A
2437777	12/2006	GB	N/A
S57175247	12/1981	JP	N/A
S5916254	12/1983	JP	N/A
59075549	12/1983	JP	N/A
600015546	12/1984	JP	N/A
600021440	12/1984	JP	N/A
06038957	12/1993	JP	N/A
H10211196	12/1997	JP	N/A
H11230918	12/1998	JP	N/A
2001176408	12/2000	JP	N/A
2001233440	12/2000	JP	N/A
2003126075	12/2002	JP	N/A
2004000605	12/2003	JP	N/A
2004079128	12/2003	JP	N/A
2005013768	12/2004	JP	N/A
2005257400	12/2004	JP	N/A
1019920010403	12/1991	KR	N/A
100796878	12/2005	KR	N/A
1020060078151	12/2005	KR	N/A
9528715	12/1994	WO	N/A
9960387	12/1998	WO	N/A
2000049428	12/1999	WO	N/A
03051201	12/2002	WO	N/A
03105159	12/2002	WO	N/A
2004037088	12/2003	WO	N/A
2004111625	12/2003	WO	N/A
2005091227	12/2004	WO	N/A
2005084351	12/2005	WO	N/A
2006119603	12/2005	WO	N/A
2006119605	12/2005	WO	N/A
2006135586	12/2005	WO	N/A
2007051092	12/2006	WO	N/A
2007055720	12/2006	WO	N/A
2007103216	12/2006	WO	N/A
2009106857	12/2008	WO	N/A

OTHER PUBLICATIONS

US 5,987,079 A, 11/1999, Scott (withdrawn) cited by applicant
International Search Report for PCT/GB2004/001747, Aug. 10, 2004, CXR Ltd. cited by applicant
Sun Olapiriyakul and Sanchoy Das, Design and analysis of a two-stage security screening and inspection system, Journal of Air Transport Management, vol. 13, Issue 2, Mar. 2007, pp. 67-74. cited by applicant
Kelly Leone and Rongfang (Rachel) Liu, The key design parameters of checked baggage security screening systems in airports, Journal of Air Transport Management, vol. 11, Issue 2, Mar. 2005, pp. 69-78. cited by applicant
Viggo Butler and Robert W. Poole, Jr., Rethinking Checked-Baggage Screening, Reason Public Policy Institute, Policy Study 297, Jul. 2002. cited by applicant

McLay, Laura A., Jacobson, Sheldon H., and Kobza, John E., A multilevel passenger screening problem for aviation security, Naval Research Logistics (NRL), vol. 53, issue 3, pp. 183-197, 2006. cited by applicant
ClearView Workstation, L3 Security & Detection Systems, Jun. 9, 2011. cited by applicant
Rapiscan Security Products, Inc., Users Guide for Level 3 Threat Image Projection (TIP) System Manual, Aug. 4, 1999, document in general. cited by applicant
International Search Report for PCT/US2006/11492, Oct. 11, 2007, United Technologies Corporation. cited by applicant
International Search Report for PCT/US2007/005444, Oct. 29, 2007, Telesecurity Sciences, Inc. cited by applicant
International Search Report for PCT/GB2009/000575, Apr. 7, 2010, Rapiscan Security Products Inc. cited by applicant
'Development and Validation of a Test of X-ray Screener Readiness' Eric C. Neiderman, Ph.D., et al. IEEE, 2000. cited by applicant
'Test and Evaluation Plan for Screener Proficiency Evaluation and Reporting System (SPEARS) Threat Image Projection' J.L.Fobes, Ph.D., et al. FAA, Dec. 1995. cited by applicant
'Revised Test and Evaluation Plan for Determining Screener Training Effectiveness' Brenda A. Klock, et al. FAA, Aug. 2000. cited by applicant
Rapiscan Security Products, Inc., Users Guide for Levels 1 and 2 Threat Image Protection (TIP) Users Manual, Jan. 12, 2001, document in general. cited by applicant
Horner et al., "Phase-Only Matched Filtering", Applied Optics, vol. 23, No. 6, Mar. 15, 1994, pp. 812-816. cited by applicant
Mahalanobis, et al. "Minimum Average Correlation Energy Filters", Applied Optics, vol. 26, No. 17, pp. 3633-3640, Sep. 1987. cited by applicant
Kumar et al. "Spatial frequency domain image processing for biometric recognition", Biometrics ICIP Conference 2002. cited by applicant
Caulfield, et al. "Improved Discrimination in Optical Character Recognition", Applied Optics, vol. 8, pp. 2354-2356, Nov. 1969. cited by applicant
Morin, et al. "Optical Character Recognition (OCR) in Uncontrolled Environments Using Optical Correlators", Proc. SPIE Int. Soc. Opt. Eng. 3715, 346; 1999. cited by applicant
International Search Report for PCT/US2012/054110, Dec. 24, 2012. cited by applicant
International Search Report for PCT/US2017/017642, Jun. 29, 2017. cited by applicant
Victor J. Orphan, Ernie Muenchau, Jerry Gormley, and Rex Richardson, "Advanced γ ray technology for scanning cargo containers," Applied Radiation and Isotopes, vol. 63, Issues 5-6, 2005, pp. 723-732. cited by applicant
International Search Report for PCT/GB09/00575, Apr. 7, 2010. cited by applicant

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Background/Summary

CROSS REFERENCE
(1) The present application is a national stage application of PCT/GB2009/000575, filed on Feb. 27, 2009, which further relies on Great Britain Patent Application Number 0803644.4, filed on Feb. 28, 2008, for priority. The applications are incorporated herein by reference in their entirety.
FIELD OF THE INVENTION

(2) The present invention relates to scanning systems. It has particular application in scanning systems for cargo.

BACKGROUND

(3) There is a requirement to be able to screen cargo items for the presence of illicit materials and devices for the protection of the public.

(4) Currently, such inspection may be undertaken using X-ray based screening apparatus. In these systems, an X-ray image of the object under inspection is taken and an operator reviews this image to resolve, in their experience, whether the cargo is clear for onwards travel or whether the cargo requires a further level of inspection. However greater volumes of cargo traffic and greater desire and need for security scanning have lead to an increasing need to increase the throughput of scanning systems.

SUMMARY OF THE INVENTION

(5) The present invention provides a cargo scanning system comprising a plurality of scanners each arranged to scan a respective object and generate a set of scan data, processing means arranged to process each set of scan data to determine whether it meets a predetermined threat condition, and data management means arranged to direct data that meets the threat condition to a workstation, or one of a plurality of workstations, for analysis.

(6) The present application is directed toward cargo scanning systems having scanners, each arranged to scan a respective object and generate a set of scan data, processors arranged to process each set of scan data to determine whether it meets a predetermined threat condition, workstations, and data management system arranged to direct data that meets the threat condition to one of the workstations for analysis.

(7) The data management means may comprise a job dispatcher. The job dispatcher may be arranged to coordinate the tasks which are directed to each of the workstations. The data management means may further comprise a threat detection processor, which may be arranged to process image data to allocate the data to a threat category automatically, for example using one or more image processing algorithms. The data management means may also comprise a threat injector, which may be arranged to input test image data defining an image of a threat item. These different functions of the data management system can be provided as separate processors, or can be provided as different functions of a single processor.

(8) The system may further comprise a cargo movement control means arranged to control movement of the objects through the scanners. Where the system is arranged to scan cargo carried on road-going vehicles the movement control means may include traffic lights and other signs and indicators for the driver of the vehicle. Where the system is arranged to scan rail cargo, the movement control means may include points on the railway. Where the system is arranged to scan cargo on a conveyor, the movement control means can include the conveyor.

(9) The system may further comprise a holding bay and the movement control means may be arranged to hold one of the objects in the holding bay in response to the object meeting the threat condition. The movement control means may be arranged to cause the object to bypass the holding bay if it does not meet the threat condition.

(10) According to some embodiments of the invention, a multi-level inspection process is provided which seeks to automate the scanning process to allow higher throughput and lower screening cost per cargo item.

(11) The present invention further provides a method of scanning cargo comprising providing a plurality of scanners, scanning a respective object with each of the scanners to generate a respective set of scan data, processing each set of scan data to determine whether it meets a predetermined threat condition, and directing data that meets the threat condition to a workstation for analysis.

(12) Preferred embodiments of the present invention will now be described by way of example only with reference to the accompanying drawings.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) FIG. **1** is a schematic diagram of a scanning system according to an embodiment of the invention;

(2) FIG. **2** is a schematic view of part of the scanning system of FIG. **1**;

(3) FIG. **3** is a schematic plan view of a scanning system according to a further embodiment of the invention;

(4) FIG. **4** is a schematic diagram of a threat detection system forming part of a scanning system according to a further embodiment of the invention; and;

(5) FIG. **5** is a schematic diagram of a cargo security system according to a further embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

(6) Referring to FIG. **1**, a scanning system according to one embodiment of the invention comprises a number of scanners **10**, which can be for example static, moving gantry or mobile scanners, each of which is arranged to scan a cargo container to generate image data. In this case the scanners **10** are arranged over a roadway **11** so that they can scan road-going cargo trucks. A storage array **12**, threat detection processor **14** and job dispatcher **16**, which generally includes a computer with a processor, are all connected to the scanners **10** and to each other by a data switch **18** or other suitable data transmission system. The data switch is also connected to a network of workstations **20**. Each of the workstations **20** includes a display **22** arranged to display the image data in the form of an image for viewing by an operator, and a user input **24**, in this case in the form of a mouse, which enables the operator to allocate one of a number of threat categories to each image.

(7) The scanners **10** are able to operate independently and at high throughput. A typical scanner comprises an X-ray generator **30**, a set of X-ray detector arrays **32**, **34** each comprising a number of individual detectors **36** each arranged to generate an output signal. The scanner may be a drive-through scanner, or it may include means, such as a movable gantry, to scan the cargo item through an X-ray beam which fires from the X-ray generator **30** through the cargo item and onto the set of X-ray detectors **36**. A two-dimensional image data set is formed by the scanner from the detector output signals. That data set contains information about the cargo item under inspection. In some embodiments more than one X-ray beam is used. In this case the beams may be used to generate two-dimensional image data sets, or three dimensional image data sets. In either case the image data from a series of scans is typically in a form that can be used to build up a three-dimensional image of the cargo item. The scanners **10** pass the image information through the data switch **18** which is able to route the information directly from the scanners **10** to the other nodes **12**, **14**, **16**, **20**. Typically, a scan will generate data in the form of Ethernet packets and the data switch **18** is therefore simply an Ethernet switch.

(8) In the embodiment described here, data from the scanners **10** is passed directly to the central storage array **12** and the job dispatcher node **16** which is therefore arranged to receive from the generating scanner **10** the new cargo image data.

(9) The job dispatcher **16** is then arranged, on receipt of any new image data set, to allocate time on the threat detection processor **14** for automated analysis of the new image data. Advantageously, the image data produced by the scanner **10** will have multi-energy attributes such that a detailed materials discrimination algorithm can be executed first by the threat detection processor **14**, followed by an automated detection algorithm. Once the threat detection processor has analysed the image data produced by the scanner **10**, it is arranged to notify the job dispatcher **16** of its conclusions.

(10) If a threat item (e.g. a material or device) has been detected by the threat detection processor

14, the job dispatcher **16** is arranged to allocate an operator to review the image data produced by the scanner to resolve the severity of the threat item(s) that were detected by the threat detection processor **14**, and to transmit the image data to one of the workstations **20**, or simply make the data available for retrieval and analysis by the operator. The operator will utilise one of the networked operator workstations **20** that has the capability to manipulate the image data for optimal display.

(11) Once the operator has made their decision, and input it as an operator decision input to the workstation using the input device **24**, the result (either that the cargo is in fact clear for onwards travel or that it does indeed contain threat materials or devices) is forwarded to the job dispatcher **16** by the operator workstation. This can be done by sending the image data back with the decision attached to it in the form of a threat categorization, or by sending the decision, again for example as a threat categorization, with an identifier which uniquely identifies the image data set. The job dispatcher **16** is then arranged to notify the scanner **10** of the result.

(12) In the event that a cargo item is flagged or categorized by the operator at the workstation **20** as containing a threat material or device, the facility manager is also notified, and a traffic management system controlled as described in more detail below to direct the cargo items appropriately, such that the threat cargo item can be quarantined until such time as an operative is available for manual search of the cargo item.

(13) Typically, the threat detection processor **14** can be optimised to deliver a low false alarm rate to minimise the congestion and process delays that are caused when a threat cargo item is detected. The corollary of this is that the true detection rate will also be low. In this situation, very few operators are required in order to inspect image data from large numbers of scanning devices. This ensures a low screening cost per cargo item.

(14) In this low false alarm rate scenario, it is reasonable to send a fraction of all the scanned images to the network of operators using random scheduling of cargo items which were cleared by the threat detection processor **14**.

(15) This ensures that good inspection coverage of all the cargo items that are passing through the facility is achieved.

(16) In a further mode of operation of the system, the balance between false alarm rate and detection probability is adjusted such that a higher detection rate is achieved but with a consequent increase in false alarm rate. In this scenario, more operators will be required in order to confirm or reject the cargo items following automated threat detection processing. At this higher false alarm rate level, it is unlikely that additional random inspection of automatically cleared containers will be required. The use of more operators pushes up the cost of screening containers but this comes at the benefit of an enhanced detection probability.

(17) The threat detection processor **14** can be set to any particular sensitivity to suit the environment in which the system is to be used. However in this embodiment the sensitivity of the threat detection processor **14** is adjustable so that the operation of the system can be adjusted to suit the prevailing conditions. This means that where the threat detection processor is arranged to allocate each item to one of a number of threat categories, corresponding to different levels of threat, the category to which any particular images will be allocated can be adjusted so as to adjust the proportion of items that will be allocated to each of the categories. The threat detection processor can be arranged to adjust this allocation on the basis of one or more inputs, for example inputs indicative of an overall threat level, the volume of traffic which needs to be scanned, or the number of operators available to review the images. In a modification to this arrangement, the threat detection processor **14** can be arranged to allocate the items in the same way at all times, and the job dispatcher **16** can be made adjustable so that it allocates jobs to the workstations, and controls the flow of traffic in a way which is variable and adjustable in response to the same variables.

(18) In a further embodiment of this invention, a further network node is added in the form of a threat injector **40**. The threat injector node **40** comprises a computer **42** having a processor **44** and

memory **46**, with a library, stored in the memory **46**, of images of threat items that have been collected under controlled conditions using scanners identical to those 10 in use in the installation. Using a scheduling algorithm that is controlled by the job dispatcher **16**, image data that has been cleared by the threat detection processor **14** is passed to the threat injector **40**. The threat injector **40** superimposes a threat object image from its library of stored images into the true cargo image in order to create a hybrid image that now contains a known threat in an otherwise clear image.

(19) This hybrid image is then dispatched by the job dispatcher **16** to one of the workstations **20** for an operator review. The operator will be expected to find and mark the threat object. When the operator threat categorization decision is input at the workstation **20** and returned to the job dispatcher **16**, the job dispatcher will send a notification to the workstation **20** to notify the operator that a known threat had been inserted into the image and will confirm whether the operator located the threat correctly. This information is then stored in a database of records, as part of one of the records which is relevant to the particular operator, in order to build up a picture of the individual operator's performance standard.

(20) In a practical realisation of this invention, each workstation **20** can be arranged to display to an operator approximately 10% hybrid threat images, and 90% pure scanned images, in order to keep them occupied and well trained. The nature and complexity of the threat images that are injected are arranged to be variable and dependent on the identity of the operator, so that the testing can be balanced against the performance ability of the observer. This allows targeted training programmes to be established by the facility managers to ensure optimal human operation of the screening system.

(21) In a modification to this system, instead of a hybrid image being generated as described above, a test image representing a threat object is simply selected from a library of test images and sent to one of the work stations **20**, and the response of the operator monitored to see whether their categorization of the image is correct.

(22) The job dispatcher **16** can be arranged to allocate jobs to individual workstations or workstation operators on the basis simply of the current workload of each operator, which the job dispatcher can determine from the tasks it has already allocated, and results it is waiting for from each operator, and the threat category to which the threat detection processor has allocated the item. However where the system has a record or profile associated with each operator, the allocation of tasks to operators can also be made on the basis of the profile. For example in some case the threat detection processor may allocate items to different categories not just on the basis of a level of threat that it associates with the item, but also on the basis of the type of threat, for example the type of threat object that has been detected or the category of threat material that has been detected. Where the operator profile includes types of threat that each operator is able to analyse, or a degree of proficiency of each operator at analysing each type of threat, the job dispatcher can allocate each task to an operator at least on the basis of this information to match each task to an operator suitable to perform it.

(23) Each operator workstation **20** has the facility to annotate the displayed image, in response to inputs from the user input **24**, in order to mark up an image to indicate the presence and type of threat objects and materials that have been detected in the cargo item.

(24) In a further modification to this embodiment of this invention, to facilitate the smooth operation of each scanning device **10**, the job dispatcher **16** is able to cause the scanning system to route the passage of cargo items at its exit depending on the results of the automated detection processor and of any subsequent human inspection of the image data. For example, as shown in FIG. **2**, each of the scanners **10** can have a holding bay **50** which a vehicle can enter after passing through the scanner, with a traffic control system, such as traffic lights **52**, arranged to direct vehicles that have passed through the scanner **10** into the holding bay, or past the holding bay **50**. If the automated threat detection processor **14** detected the presence of a threat item or material, of the traffic lights **52** adjacent to the scanner **10** will be controlled by the job dispatcher **16** to direct

the load to the holding bay **50** until such time as the operator has input their response. When the operator response has been received by the job dispatcher **14** it is arranged to control further traffic controls, such as a further set of traffic lights **54**, to indicate that the cargo is free to leave the scanning site, or that it needs to move on to another area for example for manual searching.

(25) To maximise throughput of the installation, the automated threat detection processor **14** is arranged to generate a decision relating to a cargo item in a time period which is short compared to the overall scanning time for the cargo item. The job dispatcher **16** is arranged to be capable of allowing a scanner **10** to continue scanning new cargo items even if a cargo item is located in the associated holding bay **50** awaiting an operator decision.

(26) The embodiments of FIGS. **1** and **2** are arranged to scan and control cargo carried on road vehicles, and the traffic management systems therefore rely on traffic lights and other suitable indicators or signs to direct the driver of the vehicle where to drive. However in another embodiment the system is arranged to scan cargo transported by rail. In this case the traffic management systems comprise traffic lights and also points on the rail tracks, for example at the exits **62** from the scanners in FIG. **3**, that can be switched to determine the route which the cargo takes.

(27) The job dispatcher **16** is also arranged to control queuing of multiple suspect cargo items in the holding bay in order to maximise throughput of the screening installation.

(28) Referring to FIG. **3**, in a further embodiment, a security installation is similar to that of FIG. **2** but comprises a number of scanners **60**, each with an associated traffic control system **61**, and arranged to scan cargo items in parallel. The exits **62** from all of the scanners **60** lead to a shared quarantine area **64** that serves all of the scanning systems **60**. The traffic control systems **61** which comprise traffic lights or equivalent traffic management systems, are arranged to direct traffic either straight through scanners **60** to the exit of the scanning installation or, in the event of a threat being detected, to direct the load to the quarantine area **64** where further traffic management systems **66** are provided and arranged to route cargo loads to the exit of the installation following manual search as required.

(29) Referring to FIG. **4**, in further embodiments of the invention, which can be otherwise similar to those of FIGS. **1** to **3**, the job dispatcher **16***a* is similar to that of FIG. **1**, but is also arranged to receive, use and manage one or more different forms of information in addition to X-ray image data. This could typically include video images of the cargo load, which the job dispatcher **16***a* is arranged to receive from one or more video cameras **70**. It can also include optical character recognition data related to container numbering, which can either be obtained by an image processor **72** arranged to process images from the video cameras, or a separate processor **74** arranged to receive and process images from an imaging device **76** specifically arranged to image a part of the container that carries the numbering. The information can also include scanned images of manifest information that may be provided with the cargo item. It may include data from secondary sensors such as weighbridge data from a weighbridge **78** indicative of the weight of the container, data from chemical detectors or ‘sniffers’ **80** indicative of the presence of one or more chemical compounds in the container, passive gamma ray data from a gamma ray detector **82** or neutron sensing data from a neutron sensor **84**. The secondary sensors are shown here is present at the scanner site and part of the installation, but any of them can equally be at a separate location, and arranged to store the data they provide on a data carrier so that it can be input to the job dispatcher, or to transmit the data to the job dispatcher with some form of identification of the container it relates to. Where this ancillary data is available, the job dispatcher **16***a* is typically arranged to pass the data to the automated threat detection processor which is arranged to use it as an input to the threat detection algorithm that it uses in order to assist it in making the best possible threat categorization decision.

(30) Referring to FIG. **5**, in a further embodiment of the invention a cargo security system is similar to that of FIGS. **3** and **4**, but the system is arranged to scan cargo carried by rail on a rail

train **81**. The parts of the system are distributed over larger distances so as to enable an efficient flow of cargo traffic. The system is arranged to scan and categorize cargo arriving at a port **80** on a vessel **82**. The system includes a number of scanners, and all of the sources of secondary data described above with reference to FIG. **4**, but these are distributed at a number of locations **84** along the rail route between the port **80** and a final quarantine or checking area. In particular the scanners **60** are at one location **84***a* close to the port **80** where they can be used to scan the cargo shortly after it has been loaded onto the rail vehicle **81**, and the final checking area is provided at another location **84***b* further away from the port which may be at a destination of the cargo where it is removed from the rail vehicle **81** carrying it, and any individual cargo items or containers which are identified as a possible threat can be checked without delaying the progress of containers which are not identified as a threat. A traffic management system similar to that of FIG. **3** including rail points and traffic lights is used to control the route of each item of cargo, into or past the checking area **86**, dependent on the analysis of the scan data and other secondary data by the threat detection processor. This arrangement means that the cargo items do not need to be delayed close to the port **80**, and can be moving away from the port, and towards their final destination, while the threat detection analysis is being performed.

Claims

1. A non-transient computer readable medium comprising a plurality of programmatic instructions that, when executed by at least one processor: receive scan data, wherein the scan data are representative of contents positioned within one or more containers; perform an automated detection process on the scan data; receive descriptive information of the contents of the one or more containers; assess the scan data based on the automated detection process; for a first portion of the assessed scan data, acquire a threat object image from a library of images representative of known threats and combine the threat object image with the first portion of the assessed scan data to generate hybrid scan data; and send the hybrid scan data and a second portion of the assessed scan data to an operator workstation, wherein the second portion of the assessed scan data does not have a threat object image from the library of images representative of known threats and wherein an amount of the second portion of the assessed scan data is greater than an amount of the hybrid scan data.
2. The non-transient computer readable medium of claim 1, wherein, when executed by the at least one processor, the plurality of programmatic instructions automatically allocate the hybrid scan data and the second portion of the assessed scan data to at least one operator workstation for analysis.
3. The non-transient computer readable medium of claim 1, wherein, when executed by the at least one processor, the plurality of programmatic instructions generate optical character recognition data indicative of characters associated with the one or more containers.
4. The non-transient computer readable medium of claim 1, wherein, when executed by the at least one processor, the plurality of programmatic instructions execute a material discrimination process on the scan data.
5. The non-transient computer readable medium of claim 4, wherein, when executed by the at least one processor, the plurality of programmatic instructions first executes the material discrimination process on the scan data and then subsequently executes the automated detection process on the scan data.
6. The non-transient computer readable medium of claim 5, wherein, when executed by the at least one processor, the plurality of programmatic instructions is configured to display the hybrid scan data and the second portion of the assessed scan data on an operator workstation after the material discrimination process and the automated detection process is performed on the scan data.
7. The non-transient computer readable medium of claim 1, wherein, when executed by the at least

one processor, the plurality of programmatic instructions combines the threat object image with the first portion of the assessed scan data by superimposing the threat object image onto an image corresponding to the first portion of the assessed scan data.

8. The non-transient computer readable medium of claim 7, wherein the first portion of the assessed scan data combined with the threat object image corresponds to an image of contents without a threat.

9. The non-transient computer readable medium of claim 1, wherein, when executed by the at least one processor, the plurality of programmatic instructions determines a severity of a threat item based on the scan data.

10. The non-transient computer readable medium of claim 1, wherein, when executed by the at least one processor, the plurality of programmatic instructions receives decision data from an operator workstation, wherein the decision data comprises a categorization of the threat item.

11. The non-transient computer readable medium of claim 1, wherein, when executed by the at least one processor, the plurality of programmatic instructions generates and transmits a notification based on the decision data.

12. The non-transient computer readable medium of claim 1, wherein, when executed by the at least one processor, the plurality of programmatic instructions allocates each threat item to one of a number of threat categories and wherein each of the threat categories corresponds to a different level of threat.

13. The non-transient computer readable medium of claim 1, wherein, when executed by the at least one processor, the plurality of programmatic instructions allocates the hybrid scan data and the second portion of the assessed scan data to one or more operator workstations based on an overall threat level.

14. The non-transient computer readable medium of claim 1, wherein, when executed by the at least one processor, the plurality of programmatic instructions allocates the hybrid scan data and the second portion of the assessed scan data to one or more operator workstations based on a volume of traffic.

15. A method implemented by at least one processor configured to execute a plurality of programmatic instructions in a non-transient computer readable medium, the method comprising: receiving scan data, wherein the scan data are representative of contents positioned within one or more containers; performing an automated detection process on the scan data; receiving descriptive information of the contents of the one or more containers; assessing the scan data based on the automated detection process; for a first portion of the assessed scan data, acquiring a threat object image from a library of images representative of known threats and combining the threat object image with the first portion of the assessed scan data to generate hybrid scan data; and sending the hybrid scan data and a second portion of the assessed scan data to an operator workstation, wherein the second portion of the assessed scan data does not have a threat object image from the library of images representative of known threats and wherein an amount of the second portion of the assessed scan data is greater than an amount of the hybrid scan data.

16. The method of claim 15, comprising automatically allocating the hybrid scan data and the second portion of the assessed scan data to at least one operator workstation for analysis.

17. The method of claim 15, comprising generating optical character recognition data indicative of characters associated with the one or more containers.

18. The method of claim 15, comprising executing a material discrimination process on the scan data.

19. The method of claim 18, comprising first executing the material discrimination process on the scan data and then subsequently executing the automated detection process on the scan data.

20. The method of claim 19, comprising displaying the hybrid scan data and the second portion of the assessed scan data on an operator workstation after the material discrimination process and the automated detection process is performed on the scan data.

21. The method of claim 15, comprising combining the threat object image with the first portion of the assessed scan data by superimposing the threat object image onto an image corresponding to the first portion of the assessed scan data.
22. The method of claim 21, wherein the first portion of the assessed scan data combined with the threat object image corresponds to an image of contents without a threat.
23. The method of claim 15, comprising determining a severity of a threat item based on the scan data.
24. The method of claim 15, comprising receiving decision data from an operator workstation, wherein the decision data comprises a categorization of the threat item.
25. The method of claim 15, comprising generating and transmitting a notification based on the decision data.
26. The method of claim 15, comprising allocating each threat item to one of a number of threat categories and wherein each of the threat categories corresponds to a different level of threat.
27. The method of claim 15, comprising allocating the hybrid scan data and the second portion of the assessed scan data to one or more operator workstations based on an overall threat level.
28. The method of claim 15, comprising allocating the hybrid scan data and the second portion of the assessed scan data to one or more operator workstations based on a volume of traffic.