**COEN 320 Project Description**

**Project A (Team of Two): The functional requirements of an Aircraft Monitoring System**

The functional requirements presented in Figure 1.5 describe a software to be developed to monitor the flying condition of a small single engine aircraft. The software polls sensors and checks the validity of readings obtained from these sensors. It then drives a set of dials to show the readings of key parameters such as the engine temperature and pressure. The software also monitors a set of smoke detectors on board the aircraft. Warning lamps are illuminated with red when consecutive non valid readings are received from sensors or when smoke is detected.



The software also drives a CRT display and a keyboard. Pilot requests for sensor readings or smoke detection simulation are entered through the keyboard. Messages are displayed on the CRT to reflect warning conditions or reading requested by the pilot. The following statements represent more precise functional requirements of the aircraft monitoring system:

1. The system shall perform various aircraft monitoring and recording functions.

2. The aircraft has one engine. The engine is fitted with pressure and temperature sensors.

3. The sensors are polled by the system at regular 1 second intervals.

4. All sensors readings shall be sent to dials, one for each sensor.

5. All sensor readings shall be tested to be within a safe working range.

6. When three consecutive readings from a sensor were found to be out of range, a lamp corresponding to the sensor is changed from green to red.

7. When a sensor fails to respond to a poll sequence, a time out signal is generated.

8. A timed out sensor shall be treated as if it had supplied an out of range reading

9. Three consecutive time outs shall cause a warning lamp to switch from green to red.

10. A number of smoke detectors are installed in the aircraft. When smoke is first detected, an interrupt is generated by the smoke detectors.

11. When smoke is subsequently no longer detected, an interrupt is generated by the smoke detectors.

12 The system shall switch a smoke warning lamp from green to red when a smoke detection interrupt occurs.

13. A sensor is installed in the fuel tank of the aircraft to provide information on the quantity of fuel remaining.

14. The fuel sensor shall be polled and read by the system at 1 second intervals.

15. The fuel sensor reading shall be passed to a dial.

16. A warning lamp shall be switched from green to red when a 10% or less fuel reading is obtained from the fuel sensor.

17. The system shall have the capability to support a CRT display and a keyboard

18. Measures calculated from the sensor data (such as rate of change of pressure, rate of fuel consumption, etc.) can be requested by the pilot using the keyboard.

19. These measures shall be displayed on the CRT display.

20. Out of limit readings from the sensors or smoke detectors which cause the warning red light to be set shall cause a warning message to be displayed on the CRT.

21 The warnings message shall be of a higher precedence over the measures requested to be displayed by the pilot.

22. The warning messages persist until acknowledged by the pilot via the keyboard.

23. When all warning messages have been acknowledged, the last request shall be displayed.

24. The key board shall be used by the pilot to request the system to simulate the smoke detection.

25. All smoke or no smoke interrupts shall be recorded on a magnetic medium.

26 All readings recorded on the magnetic medium shall be tagged with time at which they were received.

**Project B (Individual): Automated Commuter Train Control System**

The following paragraphs describe the functional requirements of an on-train control software component for an Automated Commuter Train System. The system is to operate throughout the metropolitan area of a large city. The system is managed using a central computer and a maintenance computer. Each train is fully automated and contains an on-board computer which communicates with the central computer and the maintenance computer. The trains in this system will be powered via a third rail. At no point will pedestrians or automobiles have access to the tracks. A communications network running parallel to the track will link the Central computer to each train. Messages will pass from train to network (or network to train) via track-side devices located on each track section. The Central computer system will coordinate scheduling data for all trains. It will send an appropriate itinerary to each train in the automated commuter train network. The Central Computer system will be capable of changing the schedule at any time, and will disseminate these changes throughout the system, via the communications network. The Central Computer system will provide information to the on-train computer about obstacles in the train’s path, such as a service vehicle or another train. This system will also warn the train about traffic signals and track switches, as well as turns and gradient changes in each section of track. The Central Computer system will monitor the positions of all vehicles on all track sections. The Maintenance Computer system will keep complete and up-to-date records on all trains, communications hardware, and other components of the automated commuter train network. The Maintenance System Database will store service and repair histories for all these components. Figure 1.7 shows the inputs and outputs of the commuter train on board control software, and the following paragraphs lists the specific functional requirements for the software.



1. The on-train control system shall direct and monitor train acceleration, deceleration, stopping patterns, door opening and closing, lighting, climate control, and announcements to passengers. The operator’s only charge will be to override the control system in the case of an emergency.

2. Train runs shall be conducted by the software according to a precise itinerary received from the central computer. Trains will stop and start at the appropriate locations and times. The system shall record the information for every run. This information shall be sent in a report to the Maintenance Database at the end of each run.

3. The on-train computer software will receive (from the central computer) and react to information on obstacles in the train’s path, such as a service vehicle or another train. It will also receive and react to information on traffic signals and track switches, as well as turns and gradient changes in each section of track.

4. The automated commuter train shall operate in three modes: a Local mode in which it will stop at every stop, an Express mode in which it will go directly to a designated stop and bypass all stops in between, and a Request-Only mode in which the train will stop only if prompted by a passenger.

5. In Request-Only mode, passengers on the train will prompt the train to stop using the Next Stop cord. Passengers waiting at the next stop will be able to stop and approaching train using a button provided at the station.

6. Each train will be equipped with a self-monitoring engine and with the following automated on-train systems: doors, brakes, lights, public address, and climate control. In the event of a malfunction, manual control will be enabled and monitored by the on-train control system.

7. Each train will have four separate brake systems: phase I brakes for general speed regulation, phase II brakes for stopping the train, emergency brakes for stopping the train in the event of failure by either phase I or II brakes, and safety brakes for extra security when the train stops to load and unload passengers.

8. Each train will have two separate door systems, left and right. Itineraries will indicate which side to open at each stop. When doors open at a stop, an on train timer will be activated. The timer will tell the system when it is appropriate to close the doors, given the stop and the time of day. Doors will not close fully until they are unobstructed.

9. In the event of equipment failure or accident, the on-train control system shall notify the Maintenance system automatically, and shall provide precise data about the problem. Appropriate data shall be made available to maintenance crews before they make service calls.