JURNAL ICAMIMIA_NURWIJAYANTI

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ARDUINO - BASED SIMULATOR OF PASSENGER COUNTER ONBOARD COMMERCIAL AEROPLANES

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Abstract-Counting passengers manually onboard aircraft is a mandatory by regulation, yet this methode takes times and may lead to delayed departure, more over onboard big aircrafts, responding this situation an electronic counting system is developed to ease counting process.

Electronic counting system could minimize error and reduce counting time, it is built on digital sensors placed beneath each seat and will be detecting the presence of a passenger while being seated.

Digital signals output from each sensor are then processed by a micro controller to be presented on an Liquid Crystal Display in the rear cabin showing the amount of passenger boarded.

Keywords : passengers. LDR, Microcontroller, seats the plane, counter

I. INTRODUCTION

Flight attendants carry out passenger counting soon after door closed and all passengers have been sitting on their seats according to boarding pass, this is done manually by walking through the aisle using mini finger tally counter.

Manual methode has some limitations as it depends on flight attendants' austherity and takes time to cross check, to ease counting process an electronic counting system has been developed, this works by sensing passenger presence data converted in to digital signals to be processed by a micro controller, the output is figure on lcd showing number of boarded passenger and remaining empty seats.

II. THEORY

A. Working Principle

Working principle of this simulator is described on figure 1 below :

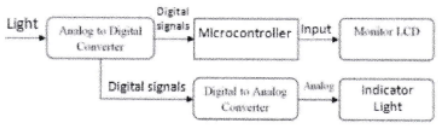

Fig.1. Block diagram of simulator

Light Dependent Resisitors (LDR) act as sensor, when lights fall on to LDR, it triggers comparator in the Analog to Digital Circuit (ADC) to output LOW logic value of 0 volt, when no lights the output will be 5,0 volt which will drive the relay to turn the LED on.
To build this simulator following components are needed: LDR module, Micro Controller Arduino, Relay module and Liquid Crystal Display.

B. Photo Resistor

Photo Resistor or commonly called as LDR (Light Dependent Resistor) is a component that has a (variable) resistance that changes with the light intensity that falls upon it. This allows them to be used in light sensing circuits. The most common type of LDR has a resistance that falls with an increase in the light intensity falling upon the device (as shown in the image above). The resistance of an LDR may typically have the following resistances: Daylight= 5000Ω Dark= 20000000Ω.

C. Micro Controller Arduino Uno

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button.The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter, revision 2 of Uno has pulling resistor 8U2 connected to ground so it is easier to use in DFU mode.

D. Liquid Crystal Display (LCD)

LCD is an electronic component used to display character, figures and or graphic, LCD is built up on CMOS logic that works by reflecting lights around it to front lit or by transmitting light from back lit. in this simulator design, a 2 x 16 LCD display is used.

E. Light Emitting Diode (LED)

LED is an electronic component that emits monochromatic lights when it got forward bias, LED is a diode made of semiconductor material, emitting colours depend on material used. Led can also emit invisible infra red light, like ones used in TV remote controller.

F. Power Supply

Power supply is an electronic device capable of providing electrical energy to other circuit or device, basically it converts main electric power in to desired voltage and power required by other device, it is also called as Electric Power Converter.

III. RESEARCH METHOD

This arduino based simulator was designed through some steps; research, collecting input data up to component design, involved hardware and software design, finally a live test was carried out to gain tolerable error value.

IV. DESIGN AND TEST RESULT

A. Simulator Design

Below is flowchart of the system:

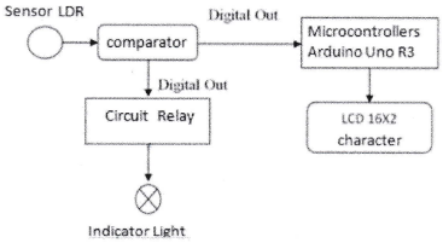

Fig. 2. Design block diagram

1. Power supply circuit

This simulator is powered by a 5 volt dc voltage derived from 12V DC power supply composed of transformator, diode bridge, capasitors 2200µF, capasitor 100ηF, capasitor 220µF,IC 7805

2. Light sensor circuit

Light sensor circuit is composed of Photo resistor and comparator.

3. 16 x 2 LCD module

Only has LCD module in the circuit

4. Arduino Uno Micro Controller

All components are connected to Micro controller through PWM enabled pin.

B. Modul Test

Output voltage measurement of each sensors are as follow:

TABLE I. DIGITAL OUTPUT FROM EACH SENSOR

No	V_{out} (volt)		Description
	Unblocked	Blocked	
1	0,14	4,67	Sensor On
2	0,13	4,66	Sensor On
3	0,14	4,65	Sensor On
4	0,15	4,67	Sensor On
5	0,14	4,67	Sensor On
6	0,14	4,66	Sensor On
7	0,13	4,66	Sensor On
8	0,14	4,67	Sensor On

TABLE II. LDR VOLTAGE IN BRIGHT AND DARK CONDITION

No	V_{out} (volt)		Description
	Unblocked	Blocked	
1	0,67	4,00	LDR On
2	0,66	4,01	LDR On
3	0,67	4,01	LDR On
4	0,66	4,02	LDR On
5	0,66	4,00	LDR On
6	0,67	4,01	LDR On
7	0,66	4,02	LDR On
8	0,67	4,01	LDR On

C. Counter Test

Test conducted to simulate actual condition by blocking seat randomly, when sensor is blocked it is assumed that seat is occupied.

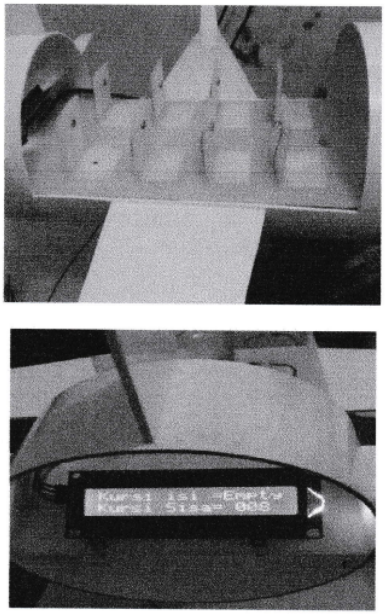

Fig 3. Test on empty seat

TABLE III. TEST RESULT ON EMPTY SEATS

No	Seat Number	Occupied Seat	
		Yes	No
1	1	-	√
2	2	-	√
3	3	-	√
4	4	-	√
5	5	-	√
6	6	-	√
7	7	-	√
8	8	-	√
Occupied Seat :		Empty	
Remaining Seat :		000	

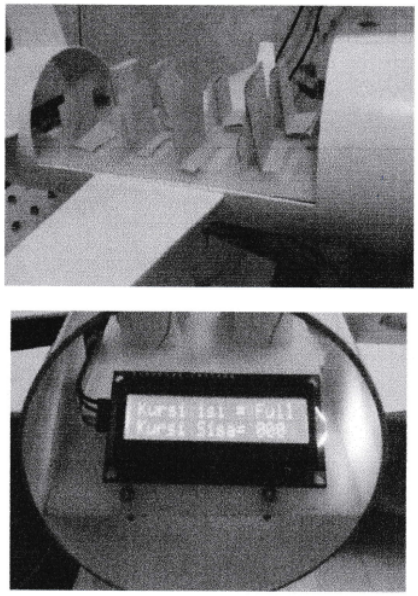

Fig 4. Test on random occupied seat

TABLE IV. TEST RESULT ON RANDOM OCCUPIED SEAT

No	Seat Number	Occupied Seat	
		Yes	No
1	1	-	√
2	2	√	-
3	3	√	-
4	4	-	√
5	5	-	√
6	6	√	-
7	7	√	-
8	8	√	-
Occupied Seat :		005	
Remaining Seat :		003	

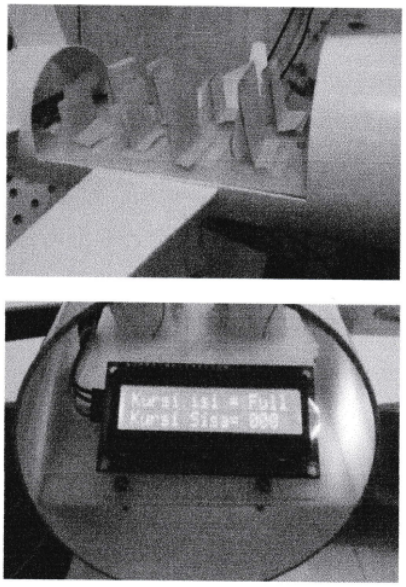

Fig 5. Test on full ocupancy

TABLE V. FULL OCCUPANCY TEST RESULT

No	Seat Number	Occupied Seat	
		Yes	No
1	1	√	-
2	2	√	-
3	3	√	-
4	4	√	-
5	5	√	-
6	6	√	-
7	7	√	-
8	8	√	-
Occupied Seat :		Full	
Remaining Seat :		000	

D. Seat Indicator Test

The test is carried out to confirm performance of relay which functions as LED trigger, where LED illuminates when seat being occupied and turn off when seat is empty, this works when LDR is blocked and outputs *High logic* as input to relay modul.

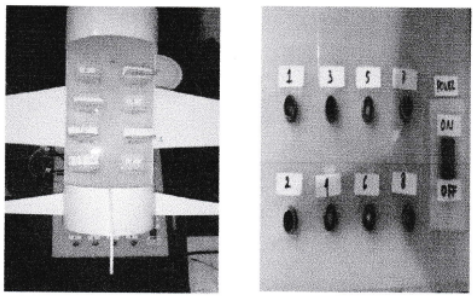

Fig. 6. Seat indicator test on empty and occupied seat

TABLE VI. TEST RESULT OF LED INDICATOR AND INPUT RELAY

No	Vinput Relay		Relay Function	
	LDR Unblocked	LDR Blocked	LDR Unblocked	LDR Blocked
1	0,67	4,40	OFF	ON
2	0,67	4,42	OFF	ON
3	0,68	4,40	OFF	ON
4	0,67	4,41	OFF	ON
5	0,68	4,41	OFF	ON
6	0,67	4,42	OFF	ON
7	0,68	4,41	OFF	ON
8	0,68	4,40	OFF	ON

V. CONCLUSION

Reffer to test and analysis on this simulator;

1. To ease passenger counting could be assisted by a digital counter that performs the number of occupied and empty seats.

2. Simulating occupied seat by blocking LDR activates relay modul with high logic of 4.41 volt DC, otherwise unblocked LDR will result in low logic of 0.67 volt DC. In turn, seat indicator LED illuminates on High logic condition and turns off on Low logic condition.

3. To convert manual counting into digital sensor system employs LDR sensor capable of taking out High digit logic of measured 4.66 Volt DC connected to Micro Controller port to be processed to display on LCD. Illumination on LDR modul could be adjusted accordingly, in this simulator voltage is set to 4.01 volt as refference.

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