DESIGN AND SIMULATION OF ELECTRONIC CONTROL AND MONITORING SYSTEM FOR BOOM SPRAYER

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SUMMARY

Boom sprayers are popular in Iran which are used for spraying in fields. Nowadays these sprayers are made in various size and dimensions. Boom sprayers all have high volume tank and wide booms and high flow rates performance. Therefore with notice to the importance environmental protection, spray deposit homogeneity, reduce spraying costs, in addition to provision for ease of work, applying new control systems to flow rate control is seem necessary. In this thesis we studied the design and implementation of a monitoring and electronic control system for TF400 model rear tractor mounted boom sprayer. This type of sprayer is used very often throughout Iran for spraying wheat, barley, potato, corn fields and even landscape itself. It has a tank with 440 liters capacity, a pistons pump that produce 20 bar pressure, three boom pieces, having a total of 8 meters length and 16 nozzles and a pressure regulator including three valves for letting/stoping flow to boom sections. In conducting research and analysing the equipment to know the most important parameters effective for optimal operation, we found out the flow rate related to pump specifications, connecting pipes length, pressure control valve, valves and size of nozzles are most important parameters to be considered in the design of controller. Therefore to devise an automatic flow rate proportional control a 0.5 inch valve (instead of conventional valves) was used. In order to design, implement and install an open loop control system on this valve, information and data were collected by a data logger. Equipments and sensors for gathering experimental data were: pressure sensors (Wika), RS232 cable, digital multimeter and a especially designed lever for opening/closing or adjusting ball valve. An electronic circuit for gathering data from pressure sensors and sending them to computer was also designed. This data were analyzed with Excel. Flow rate computed in every point of valve opening. Based on above findings, an electronic control and monitoring system was designed and implemented. This system include an AT89S51 microcontroller as centeral processing unit, a stepper motor (Mitsumi M42SP-5), a Ball valve, a four bit DSP display and a buzzer to produce alarm when tank is empty. The program for this system was written in C language by using Keil software. In this system microcontroller senses pulses which are produced by front wheel of tractor and then send necessary commands to the stepper motor in order to adjust shaft and valve shaft according to the set points for flow rate in valve. Volume of liquid in the tank in is also sensed and displayed on DSP LCD and when the tank become empty the buzzer will ring.