

## Land Leveling Device using Laser Technology

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### ABSTRACT

This paper aims to design Electronic system using technology depend on Laser beam to flattening the ground within specific inclination , high accuracy of leveling and shortest working time .The Flattening Farmlands System contain of three units (Receiver unit ,Transmitter unit and Control Box) In this paper the main purpose to redesign the Receiver unit and Control Box to be suitable and efficient with the environment of Sudan that's because the big number of failures occurs in this two units.

**Keywords**—Indicator unit; Microcontroller unit; Driver unit; LM7805 Regulator; Phototransistor.

### I. INTRODUCTION

Flattening Farmlands System (FFS) is an electronic mechanical system designed to flattening the farmland with a high accuracy and specific inclination[1, 2].

The system contains:

#### A. Receiver Control Unit

This unit received the laser beam by using phototransistor sensors arrange as a matrix to determine the highest and the lowest point for the farmland to compare it with the desired reference point after that send the digital signals to the control box[3, 4].

#### B. Transmitter Control Unit

This unit sending laser for a limited distance to cover a limited area, laser source installed on a rotary DC Motor can rotate at 360 degrees using the keypad and graphical LCD display to adjust the inclination and speed.

#### C. Control Box

This is unit receive digital signals from the receiver control unit

to apply process on it to determine the levels of the ground compared with the reference level, then to start control by the hydraulic unit to cut or fill the farmland.

#### D. Hydraulic Unit:

This unit operating to cut or fills the farmland until reaching the desired level.



Figure 1: Land Leveling Device Using Laser Technology

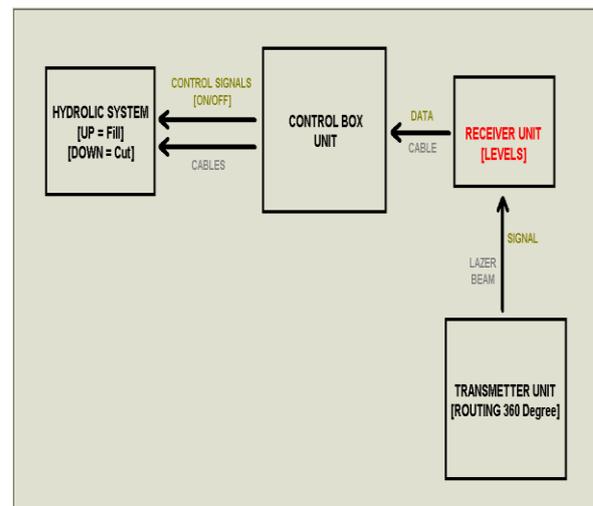


Figure 2: Flow Chart of the Flattening Farmlands System

Flattening farmlands system was regarded as the most efficient and useful engineering irrigation techniques because the benefits which can be provided through this project as the following points [5]:

- Regard as the most important strategic projects locally and internationally.

- Reduce large amounts of wasted water up to 30%.
- Contributes to reduce the employment used in the control of irrigation.
- Improvement and raise the production rate for the farmland.
- The effectiveness of the flattening process will continue for 4 years at least.

## II. RELATED STUDY

In the past, man relied on the settlement of agricultural land on primitive tools in addition to use of animals. This method is difficult and expensive and time consuming and labor intensive, moreover, does not result in accurate settlement of agricultural land. With the advancement of technology, the use of electronic systems in the field of agriculture has begun to seek to improve agricultural production and save time and effort [6-9].

## II. METHODOLOGY

Through this paper the steps and procedures which follow to design the system:

- Gathering data about the old system
- Programming and testing the software.
- Compiling the code and generate hex file.
- Running simulator for complete system.
- Design the electronic circuit for (Control Box and Receiver Control Unit).
- Evaluation of simulator results from the experimental test.
- Using the evaluating Board kit for (Real simulator).
- Design the Printed Circuit Board for (Control Box and Receiver Control Unit).
- Prototype Design for (Control Box and Receiver Control Unit).
- Design Casing for (Control Box and Receiver Control Unit).

## III. REQUIREMENTS OF CONTROL BOX UNIT AND RECEIVER UNIT DESIGN:

### A. indicator UNIT

This unit is responsible for the displaying of the current state of the electromechanical system making it easier to detect faults of disconnection between sender and receiver or break down system. These indicators help the driver of the Flattening Farmlands system to track the state of scrapper that is comforting the earth and see if the land has been successfully settled. The most commonly used electronic component for displaying the internal status is LEDs. A light-emitting diode (LED) is a semiconductor device that emits visible light when an electric current passes through it.

### B. Microcontrollers (ATMEGA32)

ATmega32A is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega32A achieves throughputs close to 1MIPS per MHz this empowers system designed to optimize the device for power consumption versus processing speed.

### C. DRIVER UNIT

It is an electronic component or electronic circuit intermediary responsible by controlling another element or electronic circuit, depending on the received electronic control signal comes from the first circuit.

This electronic system contains two kinds of drivers:

- ULN2003A IC DRIVER: The ULN2003A is an array of seven NPN Darlington transistors capable of 500 mA, 50 V outputs.
- Relays: A relay is a device which is used to provide connection between two or more points or device in response to the input signal applied.

### D. LM7805 Regulator

The voltage regulator IC 7805 is actually a member of 78xx series of voltage regulator ICs. It is a fixed linear voltage regulator. The xx present in 78xx represents the value of the fixed output voltage that the particular IC provides. For 7805 IC, it is +5V DC regulated power supply. This regulator IC also adds a provision for heat sink. The input voltage to this voltage regulator can be up to 35V and this IC can give a constant 5V for any value of input less than or equal to 35V which is the threshold limit.

### E. PHOTOTRANSISTOR

The phototransistor can be used in a variety of circuits and in a number of ways dependent upon the application. Being a low-cost device the phototransistor is widely used in electronic circuits and it is also easy to incorporate. The phototransistor symbol for use in electronic circuit diagrams is very straightforward. It is formed from the basic transistor symbol with arrows point into it to indicate that it is light sensitive.

Specification: Sensitivity Range between 740- 1100 nm. Package type: Epoxy, Radial (T 1). Sensitivity: high.

## IV. RESULT AND DISCUSSION

### A. Control Box Design

This unit consists of two parts:

- I. *Main Control Unit:* This unit reads all data from the receiver unit then send control signal to the hydraulic system and the display unit.

This unit working in two modes:

- a) *Manual:* In this mode the hydraulic unit controlled by a joystick (up or down).

- b) *Auto*: hydraulic unit controlled by solenoid valve which control by relays receives control signal from control box

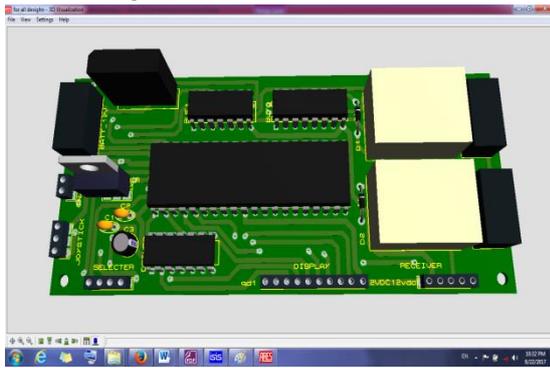


Figure 3: 3D View for the PCB of Main Control Unit

## 2) Display Unit:

Concern by displaying all the internally cases Accrue inside the system by displaying them in a group of (LED) to help the driver of the agricultural machinery, as following:

- System running mode (MANUAL /AUTO).
- Level of the Scrapper (UP / DOWN).
- Error signal in case of disconnecting between the transmitter and the receiver.

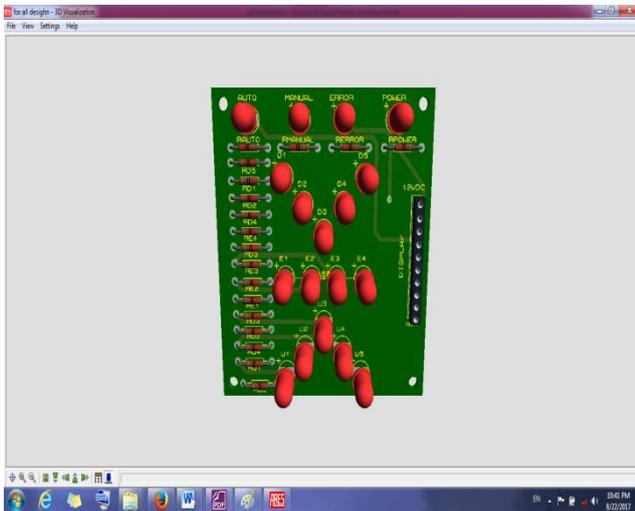


Figure 4: 3D View of Display Unit

After design the control box, the next step is to design the cover for this unit adding fan window to cooling the electronic component.

**B. Receiver Control Unit Design:** Receiver Control Unit consists of a matrix of phototransistors that acts on receiving laser beam from the Transmitter Control Unit. The matrix of phototransistors contain of three levels:

- *UPLEVEL*: The ground must be lower than the target level, and then the hydraulic unit goes up to fills the ground.

- *DOWN LEVEL*: The ground must be upper than the target level, and then the hydraulic goes down to cut the ground.
- *Middle Point LEVEL*: The ground must be equal to the target level, and then the hydraulic stop working.

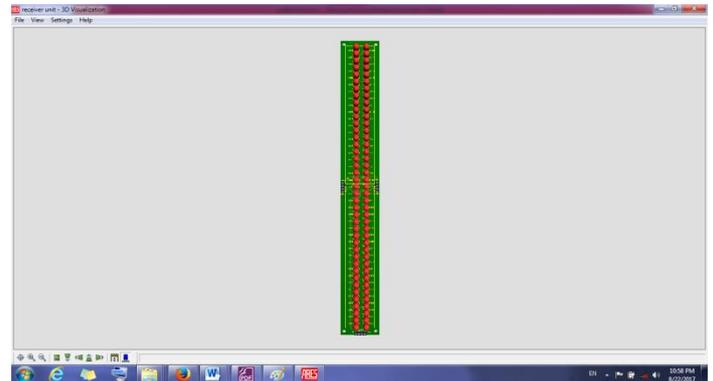


Figure 5: 3D View for PCB of the Receiver Control Unit

## V. CONCLUSION

The prototype has been tested with Hydraulic module at both mode of Auto and Manual , after running the complete system the results were satisfying, the signal received by Control Box at the different level, then process it and Actuated the Hydraulic System successfully depending on the location of the beam. After complete design the Receiver Control unit, the next step is to design the case.

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