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Design and Implementation of Automated Rotating Bridge using PLC

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Abstract: Obstacle avoidance & light following robot can be used for Industrial purpose & Military operation. The major components include an Arduino Uno R3, Servo motor, BO motor, L298N motor driver, LDR module, Ultrasonic HCSR-04 sensor & holder, Chassis body, Battery & battery holder. The system is controlled by the Arduino Uno R3 module which is an advance version of a microcontroller and a part of embedded system. In this work, we have designed a robot, which is compact, autonomous and fully functional. It is a proposed model which can be used in such an environment, which may be vulnerable and risky to human being. It has four types of functions. The functions are light following, obstacle detection and controlling from an android device through Bluetooth or Wi-Fi module& capture the video clips of that area. Obstacle avoider light follower robot detects the light (such as the light of flashlight) and follows light on travelling path. Also it can detect the obstacles while it is moving and make the passes by the obstacles. The robot has two light detection sensors which are prepared with LDRs and an infrared obstacle detecting sensor. The sensitivity of the light sensor can be set by using the trim pots.

Keywords: Robot Sensing System DC motors, Smart Phones, Motor Driver

I. INTRODUCTION

PLC is actually an intermediate device between human and machine where we have hardware and software specifically adapted to industrial environment. Blocks came with typical components, which PLC consist of, is found in the following structure. Special attention is to be given to input and output because in these blocks we can find protection needed in isolating a CPU blocks from damaging influence that industrial environment can bring to a CPU via input lines. Program unit is usually is computer based for writing a program often in Ladder Logic.

Central processing unit is the brain of a PLC controller. CPU itself is usually one of the microcontrollers. Communication interconnected among other parts PLC controller program execution, memory operation, overseeing input and setting up of an output. PLC controllers have getting up of an output. PLC controllers have complex for memory check up in order to sure that PLC memory was not damage (memory checkups is done for safety reasons). PLC controllers can be reprogrammed through a computer, but also through manual programs (console). This practically means that each PLC controller can be programmed through computer if we have the software needed for programming. Today's Transmission computers are ideal for reprogramming of PLC controller in factory itself. This is of great importance in industry. Once the system is corrected, it is also important to read the right program into a PLC again. It is also good to check from time to time whether program in a PLC has not changed. This helps to avoid hazardous situation in factory rooms. Prior to PLC, many control tasks were solved with contactor or relay controls. This is often referred to as hardwired control. Circuit diagram had to be designed, electrical components specified and wiring lists created. Electricians would then wire the components necessary to perform a specific task. If an error was made, the wires had to be reconnected correctly. A change in function or system expansion required extensive components and rewiring.

II. DESIGN OF THE SYSTEM UNIFORM

The entire circuit diagram has two major sections. One is Light following with the help of JONSHON MOTTOR & another is Obstacle detection with the help of RELAY(SPST & SPDT).

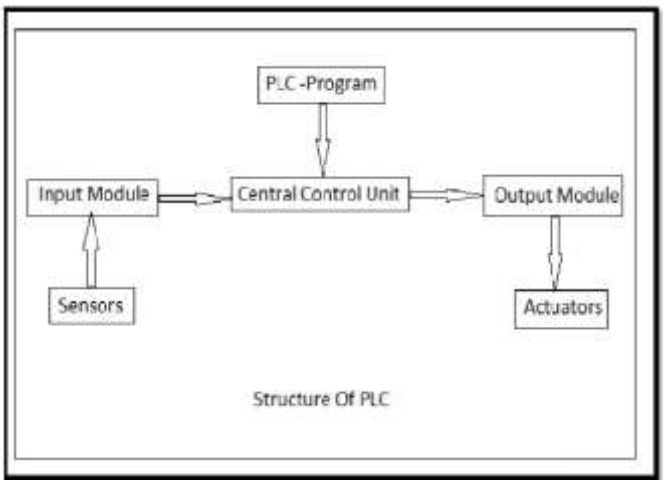

Fig. 1: Block diagram of Automated Rotating Bridge

III. CIRCUIT DESIGN AND OPERATION

Again the power produced by a single module is not sufficient to meet the power demands for most of the practical purposes. PV arrays can use inverters to convert the dc output into ac and use it for motors, lighting and other loads. The modules are connected in series for more voltage rating and then in parallel to meet the current specifications.

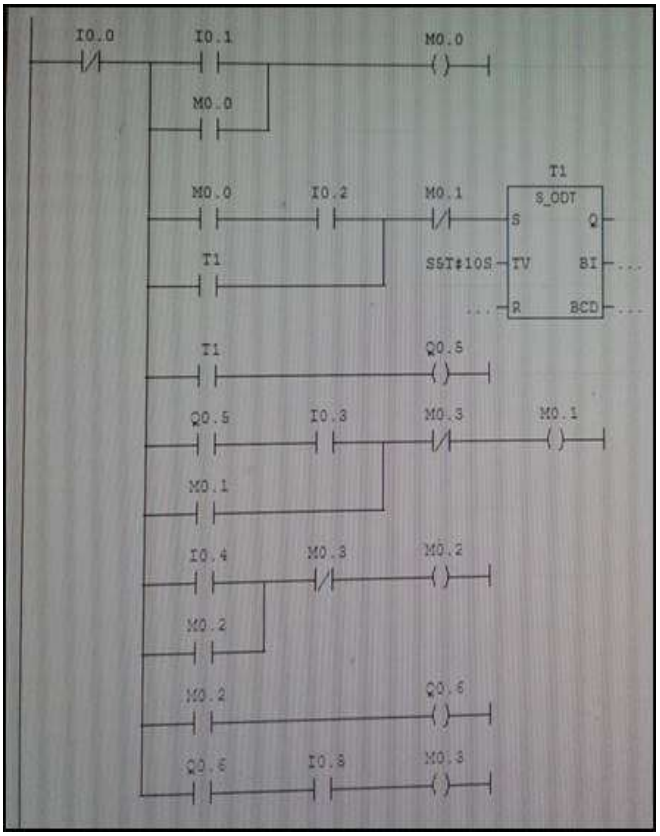

Fig. 2: Circuit diagram in Ladder Logic using SIMATIC MANAGER v5.5 for SIEMENS S7 300

IV. WORKING PRINCIPLE

The whole process is fully based upon Interlocking. The main modules of this project "Automated Rotating Bridge using PLC" are Reed switch, Motor and Limit switch. Initially, the Bridge is in contact with the Road. When Train comes towards the Bridge, the Reed switch (I 0.2) that is connected to the Railway Track senses the presence of Train and generate signals to the PLC and then automatic signal will glow as RED (M 0.1) to stop the Cars, Human that are on the Road. Simultaneously, the YELLOW (M 0.2) signal (to warn) will glow to hold the Train for 10 seconds (as per our requirement for proposed project) fed by the Logical Timer (T1). Accordingly, motor (Q 0.5) runs in forward direction and the Bridge will rotate towards the other section of the Railway Track where the Limit Switch (I 0.3) is touched and the Bridge hold there by setting the GREEN (M 0.3) signal to the Train and until the Train passes away. When the Train passes away, again there is a Read switch (I 0.4) which sense the Train and then RED signal will glow to the Track side and the YELLOW signal will glow to the Road side and the motor (Q 0.6) runs in reverse direction and the Bridge will get back to its initial position where another Limit switch (I 0.5) is there and accordingly the GREEN signal will glow to allow the Cars, Human to pass over the Bridge.

V. SYSTEMCOMPONENTS AND DESCRIPTIONS

(a) Rotating unit:

- Unit run by 12 V DC Motor
- Speed controlled using gear mechanism JONSHON Motor

Fig. 3: Prototype model

EQUIPMENTS DETAILS FOR ROTATING UNIT:-

JONSHON MOTOR :-

- dc supply
- 30r.p.m.
- High torque.
- High capacity (approx 10 kg).

GEAR MECHANISIUM:-

- Gear connected to the rotating bridge shaft.

RELAY:-

Fig. 4: Relay

- 4 number of Solid State relay.
- Input +24 v from PLC.
- Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal.

(B) Sensing unit:

- Unit runs by Read switch.
- Also Limit switch is used with 1 NO and 1 NC.

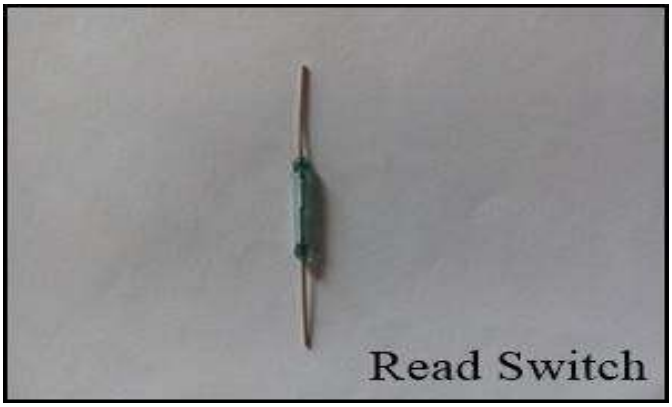

Fig. 5: Read Switch

- The Read Switch detects the magnetism (a small magnet used in Mobile Phone for our proposed system) used underneath the engine of the Toy

Train and send electrical signal to the respective input port of the PLC.

Fig. 5: Limit Switch

- The Limit Switch is used to Stop the Motor after it (the Rotating Bridge) gets to a certain limit and thereby the Rotating Bridge stopped and allow the Toy Train to run.

(c) Automatic signal:

- LED with input voltage.
- Used for signalling such as Red, Green and Yellow as usual signal.
- Resistor used for voltage drop across LED.

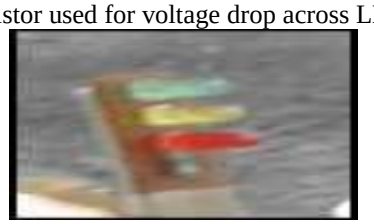

Fig. 6: LED Signal

VI. EQUIPMENT COST EFFECTIVE

EQUIPMENTS (in name)	QUANTITY (in nos.)	PRICE(in Rupees)
DC MOTOR(12VDC, 30 R.P.M)	1	550
READ SWITCH	2	26
LIMIT SWITCH	2	90
RELAY	4	160
CAPACITOR	1	6
DIODE	2	6
RESISTOR(1K/0.5W)	6	6
LED(GREEN,YELLOW,RED)	15	30
PLASTIC GEAR	2	60
CANACTOR	20	160
VARO BORD	1	45
START,STOP SWITCH	2	90
MACANICAL ALIMENT	1	3000
TOY TRAIN,CARE	1+3	600
SINGLE WIRE,5COLORS	20+20m	250
KNIFE,CUTTER	1+1	70
COLORS	6+10+3	450
PAPER,THARMOCAL,COLOR		
GUM	3	210

VII. APPLICATION& FUTURE

Application:

- Can be used in hilly area.
- Can be installed in a small subway stations where distance between the platforms are increased due to curve.
- If necessary, we can use train navigation system for safety closing an opening of Bridge.

Future:

- We can implement the Bridge for crossing of railway track for the Disabled persons so that they can cross in an effortless manner.
- We can implement some sophisticated device to check the volume of objects so that it calculates automatically weight of the objects.
- We can use it to avoid collision between train and other movable objects or living objects.

VIII. CONCLUSION

In this project "Automated Rotating Bridge using PLC", we have presented a design of a system based on Automation using SIEMENS's PLC S7 300 model. We have designed the proposed system in an economic way and given priority to safety. The inclusion of additional movable objects towards the same direction is kept at certain distance apart. Also, this project will help us to reduce time and area requirement. Human efforts are less that we can consider it to be an effective.

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