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Unique Signal System for Road Traffic

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Abstract: ***The signal system designed here is intended to raise metal rods from the underground of road when red signal is energized. This scheme is adapted to restrict the road traffic strictly. When the red light turned in to green, automatically the metal rods will be lowered to below the road level. In addition after stopping the traffic, pedestrians are allowed to cross the road, for which an automatic announcement will be made to alert them. Since it is a prototype module, basic theme is presented for single road, but for real time applications it can be implemented for all sides of the cross roads .***
The demo module is constructed with single signal post which contains red, green & yellow signals. The main processing unit constructed with 89C2051 controller chip is programmed to energize indicators one after another automatically with specific timings. Once the system is energized, initially green indicator will be glow, after some time green indicator will be switched off and yellow indicator will be glown, and then red indicator will be energized. As long as red indicator remains in glowing condition, walking person symbol simulated with green LED's will be flashed continuously until the green indicator glows. During red indicator on, metal rods remains above the road level, after that these rods will be lowered automatically. DC motor is used to raise and lower the metal rods moving mechanism. The moving mechanism is constructed with Rack & pinion. Voice record cum playback unit designed with ISD1820 chip is used to make an auto announcement such that during red signal condition "now pedestrians can cross the road" will be announced automatically. This message will be repeated until the red signal turned off. H Bridge IC is used to drive the DC motor. Especially this system is very useful for school zones.

I. INTRODUCTION

Traffic lights, also known as traffic signals are signaling devices positioned at road intersections, pedestrian crossings, and other locations to control flows of traffic. The present traffic signaling system in use now is not worthy as it functions as per the timings and never bothers about the traffic rule breakers. Means many people in busy towns are not following traffic signals, especially in outskirts of the city at many traffic signal junctions, due to the lack of traffic police presence, many people are violating signals and this leads to severe accidents. In central city also, after 11PM due to the less traffic, police person's takes leave and signals are left over to the motorists to their own decisions by which few people never bother the signals resulting accidents. To avoid such critical situations, it is necessary to restrict those law breakers by providing an automatic mechanical obstacle by which they cont. move further due to ejected metal rods raised from the underground of specific road area where signal post is existed.

The concept presented here is intended to raise metal rods automatically when red signal is energized. The microcontroller used in the project work is programmed to energize all three signal lights one after another in a sequence. Initially when the system is energized yellow indicator will be glown for few seconds and after that red indicator will be glown. When the red indicator is energized, it remains for 40 seconds and when this indicator glows, immediately rods will be raised from ground level and at the same time the walking man symbol starts flashing to alert the pedestrians to cross the road. In addition the system also utilizes voice record cum play back chip which can announce the message stored in the voice chip. The message will be in the form of "Pedestrians are requested to cross the roads". When the red indicator de-energizes, the raised rods will be lowered automatically and green indicator will be glown. Likewise the process will be repeated continuously until the system is switched off.

The signalling system functions according to the fixed timings as usual and in addition rods raising mechanism andvoice or message announcement are also incorporated for the safety of vehicle raiders and pedestrians. Since it is a prototype module, the demo module is constructed for single one way road, but for real time applications it can be implemented in cross roads. The demo module will be constructed over rectangular wooden plank over which and under which all required devices are assembled to perform the proper demonstration.

Traffic signal violation is increasingly becoming a severe problem in many cities in our country. The problem is more complex in developing cities, with the increase of population the traffic is also being increased day by day. It has become a hell kind of experience in these days to go out in the peak hours when modern technologies are not in use. At present the traffic control system is following the timer system in which a particular time period is defined for the vehicles to move. In addition, the

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devices described in this project work also must be used to enhance the safety level. By this we can control the traffic accurately, because the traffic cannot be moved further due to the raised metal railing.

Depending up on the program prepared for the controller chip in assembly language, the device performs four important tasks such as 1 - Controlling the signal lights in a sequence, 2 – Flashing the walking man signal when red light is energized, 3 – Raising the metal rods or railing from underground, and 4 – Announcing the message through voice chip. To perform these 4 activities, here the main processing unit is constructed with 89C2051 microcontroller chip. When the system energizes red light, the controller chip generates logic high signal for the voice recording cum play back chip, by which that particular voice channel will be activated and stored message will be delivered from the chip output and it will be announced through speaker.

II. CIRCUIT DESCRIPTION

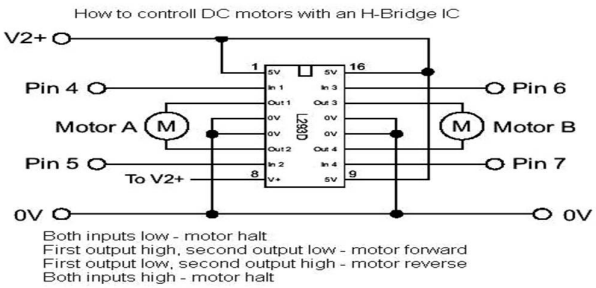
This part of the project work starts from traffic Signaling system, as per the circuit diagram shown in the next chapter, it is clear that the controller drives three indicators with a time sequence through its output port pins from pin number 14 to 16. The output port pins driving current is not sufficient to glow the indicators brightly and therefore using NPN switching transistors, signal indicators are energized brightly. Here three different colored high glow big size-LED's are used and are arranged over a small signal post. In general 5mm LED's are used but here 10mm LED's are used. When considered with signal part, the microcontroller chip is programmed such that initially when the system is energized by activating the start key connected to pin number 6 of controller chip, first the green light will be glown for 40 seconds, if required this time can be adjusted. After that, yellow LED will be glown for 5 seconds and after that red indicator will be glown for another 40 seconds. This sequence will be repeated continuously until the system is switched off.

When the red indicator is energized, the controller chip is also programmed to raise the metal rods through DC motor. The mechanical structure constructed with few thin metal rods arranged over a piece of wood, Rack, pinion, etc are coupled to the motor shaft. When the motor is energized through H Bridge IC, it moves in one direction by which rods will be raised from below the base of demo module. The demo module constructed over a rectangular wooden plank and this rods moving mechanism will be arranged below this plank. To restrict the span of moving mechanism while rising & lowering, limit switches are arranged at certain dent position such that rods rising and lowering spans are adjusted to move between two fixed reference points where limit switches are arranged. These rods remain in raising position as long as red indicator remains in energized condition. When red indicator is switched off, automatically these rods will be lowered to allow the traffic.

The walking man symbol is constructed with few 5mm green LED's, these LED's are arranged in a sequence to look like walking man symbol. These lights assembled over a PCB along with traffic signals must be arranged over a side of the wooden plank which is marked or simulated with a one way road. When the red indicator glows, this symbol also will be energized in flashing manner. Since microcontroller chip plays dominant roll in this project work, the following is the description of this device.

III. DC MOTOR DRIVER CIRCUIT

The motor drive circuit is designed with 'H' Bridge IC, for this purpose L293D is used. This is a dual H-Bridge motor driver, so with one IC, two DC motors can be interfaced which can be controlled in both clockwise and counter clockwise directions and its direction of motion can also be fixed. But here we are using only one motor and there by half of its section is used to run the motor in both directions. L293D has output current of 600mA and peak output current of 1.2A per channel. Moreover for the protection of the circuit from back EMF, output diodes are included within the IC. The output supply (VCC2) has a wide range from 4.5V to 36V, which has made L293D a best choice for DC motor driver. The name "H Bridge" is derived from the actual shape of the switching circuit which controls the motion of the motor. It is also known as "Full Bridge". All inputs are TTL compatible. Each output is a complete totem-pole drive circuit, with a Darlington transistor sink and a Darlington source. Drivers are enabled in pairs, with drivers 1 and 2 enabled by 1,2EN and drivers 3 and 4 enabled by 3,4EN. When an enable input pin is connected to high, the associated drivers are enabled, and their outputs are active and in phase with their inputs. When the enable input is low, those drivers are disabled, and their outputs are off and in the high-impedance state. With the proper data inputs, each pair of drivers forms a full-H (or bridge) reversible drive suitable for solenoid or motor applications.



IV. DESCRIPTION OF MICROCONTROLLER

The micro-controller is a chip, which has a computer processor with all its support functions, memory (both program storage and RAM), and I/O built in to the device. These built in functions minimize the need for external circuits and devices to be designed in the final applications. Most micro-controllers do not require a substantial amount of time to learn how to efficiently program them, although many of them have quirks, which you will have to understand before you attempt to develop your first application.

Along with micro-controllers getting faster, smaller and more power efficient they are also getting more and more features. Often, the first version of micro-controller will just have memory and simple digital I/O, but as the device family matures, more and more part numbers with varying features will be available. With all the 8051 manufacturer's products taken into account, there are over two hundred different 8051 part numbers, each with different features and capabilities. For most applications, we will be able to find a device within the family that meets our specifications with a minimum of external devices, or an external but which will make attaching external devices easier, both in terms of wiring and programming.

V. ATMEL 89C51 PROGRAMMING

Programming the Atmel AT89Cx051 series of 8051 microcontrollers uses somewhat of a different algorithm than what is used for the standard 40-pin devices. The AT89C51 algorithm is actually quite simple to implement. This programmer hardware can also be used to program AVR 20-pin microcontrollers. The programming can be described as erasing the control store and then presenting bytes to the microcontroller and latching it in. After the byte is latched in, the programmer waits for the byte to be saved into control store before reading it back and incrementing the AT89Cx051's program counter to receive the next byte.

To begin the programming cycle, the AT 89C51 is powered up with the Reset and XTAL1 pins held low. Then, +5V is applied to Reset and the PROG pin. At this point, the program counter inside the AT89C51 is reset to zero. After power up, the first thing we should do is a chip erase, to prepare the control store for the next program (all the control store bytes are loaded with 0FFh). This is accomplished by setting high and to low (this will be characterized as HLLL to show how the control signals are set) and pulsing PROG low for at least 10 msec. With the chip erased, the control store can be programmed. Note that Reset is cycled between +5V and +12V for writes and reads. This means that the Reset driver has to be a circuit that can output 0V, 5V, and 12V to the Reset Pin.

The lock bits are used to limit access to the application in control store of a programmed part. If lock bit 1 is programmed, then the flash control store cannot be updated until it is erased again. If bit 2 is programmed, the verify fuction (read back) will return invalid data (this is copy protection for the chip , there is no encryption array in the AT89Cx51) again until the control store on the chip is erased. For obvious reasons, these two bits should not be programmed until the application programming is complete.

Often in application programming, there will be gaps in the code, which means there are areas that are not programmed. The AT89Cx51's program counter can be incremented (by pulsing XTAL1) to skip over these areas. To carry this out, the programmer's control software will have to keep track of the current value of the program counter as it works through programming the device.

VI. AT89Cx051 PROGRAMMER CIRCUIT

For many other devices (including the PIC Micro and even the 68HCxx), there are actually quite a few simple circuits available for simply programming the Microcontroller. While not attempting to fill the gap, a perfect programmer circuit can be design and it can be used for all the AT89Cx51 applications. One nice feature of the programmer is its ability to be used in-circuit, it can be wired into a prototype circuit and have the AT89Cx051 run without having to pull the chip in an out of the programmer as circuits are being developed. Another feature is that this circuit could be used for programming 20-pin Atmel AVR micro-controllers in parallel mode.

The circuit itself is pretty simple and can be blocked out, with the programmer connected to an IBM –compatible PC via the parallel port. Power is supplied by an adaptor with at least 16V peak-to-peak. The power circuit provides switched +5 and +12V for the 8051's Vcc and Reset (0 V, +5 V or +12 V). The power circuit is controlled by the programmer control block. If Reset is being driven by something other than 0 V, the programmer drivers are active. With this circuit, it is found that, when going from +12V to +5V on Reset, 30 msec was needed. If we end up writing our own software for this circuit, we may have to make sure that we have a long enough delay before attempting to read back what was written. Going from 0 V to +5V or +12V (or from +5V to +12V) took less than a milli second.

The programmer control block is used to control the power applied to the device being programmed as well as to its Reset (as noted in the previous paragraph) and the programming mode of AT89Cx51. A 74LS374 is used with data being latched in from the PC's parallel port. The output of the '374 is always enabled, but all the lines going to the AT89Cx51 (with the exception of the power and Reset, which are independently controlled) pass through a 74LS244, which allows the AT89Cx51 to be pulled from the circuit without turning off the power to the programmer. The '244 is also used to pass the RDY/_BSY signal back to the PC to allow the programmer to poll the RDY/_BSY to determine when the programming operation has finished.

The Data, which allows a programming byte that is to be passed to the Microcontroller to read from it. It could have eliminated this pin and had the same functionality by simply using the bi-directional features of the PC's parallel port. However, to ensure that the AT89Cx51 would run in-circuit, we wanted to make sure that we could disable the connection to the PC, to make sure the cable wouldn't affect the operation of the application and, more importantly, make sure that invalid voltages or signals in the application circuit would not damage the PC.

The PC should have a parallel port capable of bi-directional I/O, and we used a switch-box dual male DB-25 connector cable. This cable is used for connecting a PC's parallel port to a printer sharing switch box. On two of the Db-25 connectors, each pin is directly connected (i.e., pin 1 is connected to Pin 1, pin 2 to pin 2, and so on), which makes wiring to the application easier.

The final circuit probably looks pretty complex; however, by following the nets, we can find that it's actually quite simple and easy to understand. What might be surprising is the component reference numbers (they don't go in any order in the schematic). They are not in any kind of logical order because we developed this raw card.

For many micro-controllers, programmers can be built very cheaply, or even built in to the final application circuit eliminating the need for a separate circuit. Also simplifying this requirement is the availability of micro-controllers with SRAM and EEPROM for control store, which will allow program development without having to remove the micro-controller from the application circuit.

VII. HARDWARE DETAILS

To prove any project work practically for the demonstration purpose, construction of described model is essential. For this purpose suitable hardware in the form of electronic, electrical and mechanical components are essential to perform the given task. When these components are integrated together or working together, better results can be obtained from the project work. Since it is a practical oriented project work, the content presented in the abstract must be proven practically. In this regard required active hardware like IC's and other special components must be gathered and their details must be described in this chapter to fulfill the concept of perfect project report.

Electronic hardware is Hardware, in the context of technology, refers to the physical elements that make up electronic system or electro-mechanical system, and everything else involved that is physically touchable. When an embedded system is considered, that contains a processing unit (Often microcontroller chips are preferred to build a processing unit) Sensors, control circuits that includes the motors, relays, switching devices (like power Mosfets, transistors, etc). Hardware works hand-in-hand with firmware and software to make a system function. Software is a collection of code installed into the microcontroller chip. Often LCD displays are used to monitor the system performance or results. But here in this project work LCD is not required the function of embedded system used here is very simple which is aimed to control the agriculture machine.

When computer is considered as example, Hardware is only one part of a computer system, but there is also firmware, which is embedded into the hardware and directly controls it. There is also software, which runs on top of the hardware and makes use of the firmware to interface with the hardware. Hardware is a surrounding term that refers to all the physical parts that make up a computer. The internal hardware devices that make up the computer and ensure that it is functional are called components, while external hardware devices that are not essential to a computer's functions are called peripherals.

The following are the active components used in this project work.

– 89C2051 Microcontroller chip

– L293D H Bridge chip

– DC Motor
– Voltage regulator
– ISD1820 Voice record cum playback chip
– Speaker
– Mic
– LM386 Audio amplifier IC

VIII. CONCLUSIONS

This project work **"Unique signal system for road traffic"** is designed and developed successfully, for the demonstration purpose a prototype module is constructed and it is arranged over a wooden plank in which raising rods from underground is simulated and in addition other required devices like, signal post, flashing type of walking man symbol, auto announcement system, etc, are also incorporated and results are found to be satisfactory. Since it is a proto type module, around 2 feet length wooden plank is selected over which all above said devices are mounted to prove the basic concept. Zebra crossing marking is also simulated for the pedestrians, when the red light energizes in the signal post, the system raises metal rods from the underground, flashing type of walking man symbol will be energized and at the same time, auto announcing system will be activated automatically to spell "now pedestrians can cross the road". The signal post that contains 3 different coloured light indicators are arranged near the zebra crossing symbol, I.e., after the raising rods point at convenient place.

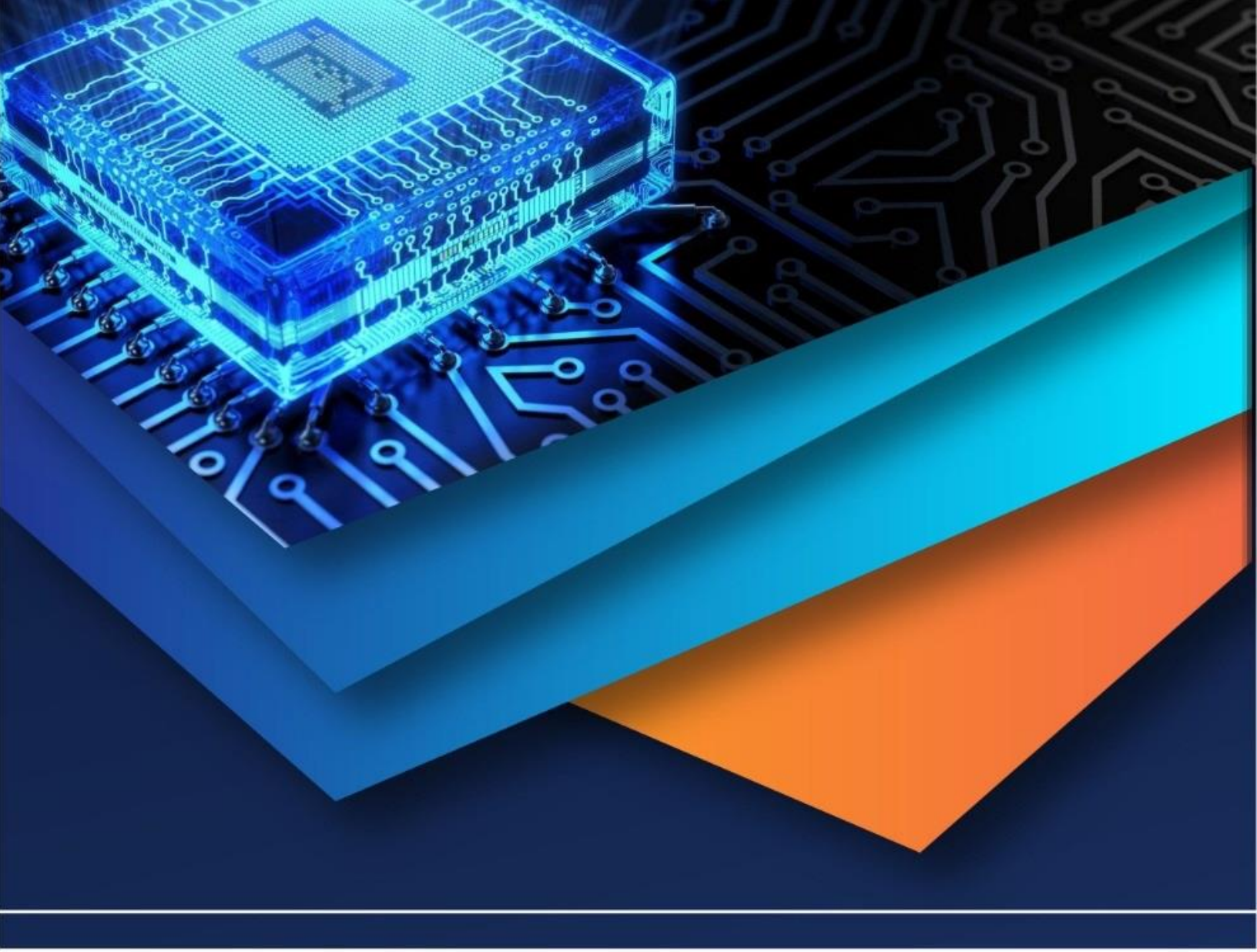
IX. FUTURE SCOPE OF THE PROJECT

Presently the system designed here is intended to use for single road traffic, but it can be enhanced to double road traffic, cross roads, etc. The sequence of timings according to the road traffic can be adjusted by modifying the microcontroller program. Presently the system designed here doesn't contain time display, if required it can be added, but it creates lot of complexity and hence it is avoided and it will be considered in future work.

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While designing and fabrication of this project work, we studied lot of material gathered from websites. Regarding micro controllers, plenty of books are available, the following are the references made during design, development and fabrication of the project work.

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