Arduino Based Evs Starting System By Using Biometric System, Numeric Keypad And Automatic Headlamp ON/OFF System

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Abstract- *The main aim of this work to protect electric vehicles and conventional vehicles from unauthorized users and to prevent the vehicle from theft by using biometric security system and numerical keypad. The work includes the requirement of fingerprint and personal identification number to access the vehicle. This helps in order to ease the use of electric two wheeler within the associated circle of people. The numerical PIN set to access the EV that can be change by user itself. The problem of losing of key can be avoided by this locking system method.*

Automatic headlamp ON-OFF system is used to avoid unnecessary used of EV battery power. With this method, excess amount of energy utilized by headlamp during daytime can be avoided by using LDR sensor.

Keywords- Arduino, Electric vehicles (EVs), Fingerprint sensor (FPS), Microcontroller (μC), Matrix Keypad, Digital Signal Processor (DSP), Microcontroller Unit (MCU), Transmitter (TX), Receiver(RX), LDR.

I. INTRODUCTION

In recent years, environmental problems caused by fuel vehicles and fuel economy become more and more serious. The vehicles of new energy, which is green, environmentally friendly and economical, is an important goal for economic and social development of many countries, but also the future development direction of the vehicle. EV is a vehicle with zero pollution emissions, mileage and fuel vehicles can be mutually comparable electric vehicles.

Security of EV can be increased by using biometric fingerprint security system. Because every person has different fingerprint so proposed system is more secure and best for EV starting. More conventional vehicles may stolen and have less chances to found it back. Under such condition, fingerprint system helps to reduce this theft. Fingerprint recognition technology allow access to only those whose fingerprint that are pre stored in memory. This problem in biometric starting system can be avoided by combining fingerprint sensor and numeric keypad using arduino. So that the authorized person can start the vehicle. Thus this new system helps to increased security of EV to great extend.

In normal electric scooter, the headlamp are used in night time and user might be forget to switch it off which will result in extra use of battery in daytime. Hence automatic headlamp ON-OFF system can be used to avoid such problem.

II. DESIGN AND ANALYSIS OF BIOMETRIC SYSTEM

The proposed system overcomes all the security problems in existing system and provide high security and efficiency. By using biometric and numeric keypad system, driver and his authorized user can start the vehicle. This is done by arduino microcontroller. Arduino μC is interfaced with the biometric fingerprint sensor and the numeric keypad.

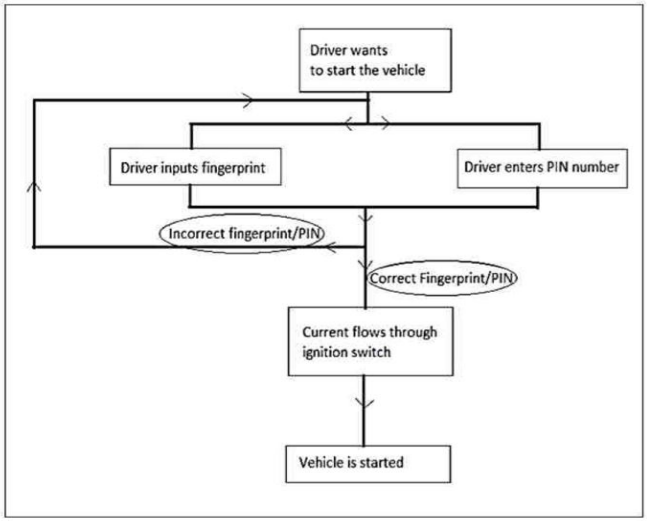

Fig.1:- Flowchart of EV starting system

The above figure contains flowchart which shows the entire process of EV starting. The model of EV starting contains following parts.

A. Biometric Fingerprint Sensor
B. Numerical (Matrix) Keypad
C. Arduino

A. Biometric Fingerprint Sensor

Biometric fingerprint sensor is a scanning device on which employees of organizations swap their fingers for biometric identification. After the fingerprints are enrolled, the fingerprint of user are scanned, analyzed and then store in coded form on secured database. Once enrolment is complete, the system is ready to use. Anyone who wants to gain access has to put their fingers on a scanner. The scanner takes their fingerprint, checks it against the print in the database stored during enrolment and decides whether the person is entitled to gain access or not granted access.

We are using R307 Fingerprint Module for this system. This R307 fingerprint module consists of an optical fingerprint sensor and high-speed DSP processor. Following chart show the pin outs of R307.

Pin	Pin Name	Details
1	5v	Regulated 5v DC
2	GND	Common Ground
3	TXD	Data Output - Connected to MCU RX
4	RXD	Data Input – Connected to MCU TX

R307 fingerprint module has two interface USB2.0 and TTL UART. USB2.0 interface can be connected to computer. The interfacing of biometric FPS with arduino microcontroller is showing in below figure.

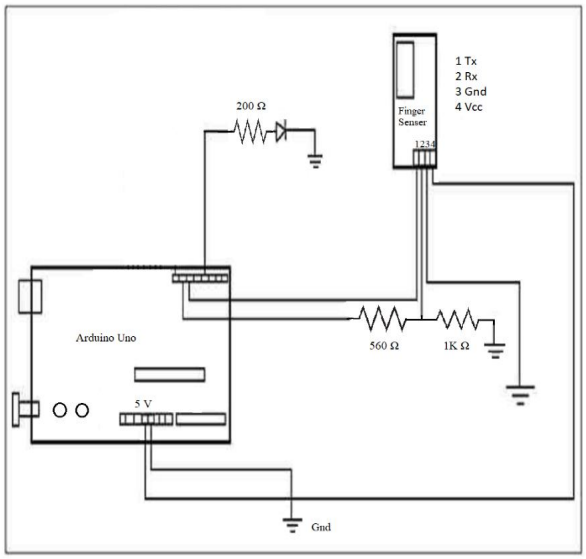

Fig.2:-Biometric FPS interfaced with Arduino Microcontroller

B. Matrix keypad

Keypad is used as an input device to read the key pressed by the user and to process it. The 4*4 matrix keypad is used as a secondary security system that enable the access of the vehicle to associated people without the user's fingerprint. The 4*4 keypad consists of 4 rows and 4 columns. The switches are placed between the rows and columns. The 8 pin microcontroller is suitable for this 4*4 keypad. The first 4 pins of this microcontroller will be outputs and will be connected to column wires and remaining 4 pins will be inputs and will be connected to row wires. This 4*4 matrix keypad has 16 built in push button which contacts connected to row and column lines. A microcontroller can scan these lines for a button press state. In a keypad library, the propeller sets all the column line to output and all the row lines to input. Then it's picks arrow and set it high. After that it check the column lines one at a time. If the column connection stays low, the button on the row has not been pressed. If it goes high, the microcontroller knows which row (the one it set high), and which column, (the one that was detected high when checked). When the user enters the pin, the microcontroller detects the input and checks it with the correct pin to give access to the vehicle.

C. Arduino

The Arduino Uno is an open source microcontroller board based on the microchip ATmega328P microcontroller. The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins and is programmable with the arduino IDE (Integrated Development Environment) via type B USB cable. It can be powered by the USB cable or by an external 9v battery, through it accepts voltages between 7 and 20 volts. The interfacing of biometric FPS and matrix keypad with arduino microcontroller is shown in below figure.

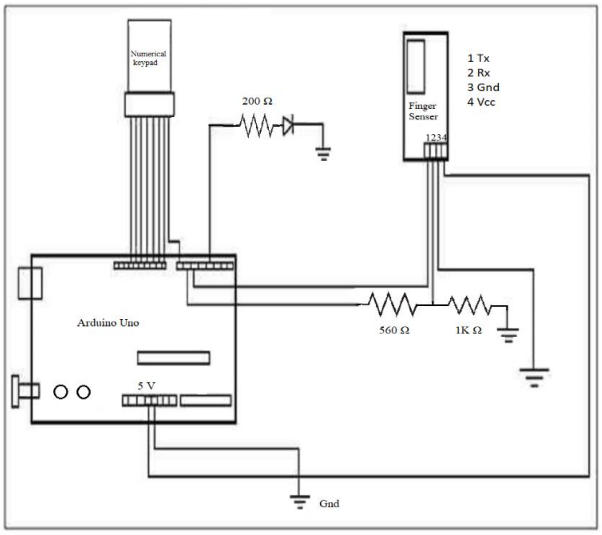

Fig.3:- Interfacing of Biometric FPS and Matrix Keypad with Arduino Microcontroller.

Initially password will be set by programming the arduino and the corresponding program will be fed to the Arduino microcontroller. Whenever anyone presses the password on the keypad, the signal will go to the arduino. Then arduino microcontroller check whether the enter password matched to stored password. If the entered password is correct the arduino will send a signal to the LED which will glow. Any mechanisms connected will be started, which in this case is the starter system of a vehicle. If the password is wrong then the LED will not glow.

III. DEVELOPMENT OF AUTOMATIC HEADLAMP ON/OFF SYSTEM

Electric scooter works on energy stored in battery. So there must be minimum utilization of energy throughout the run. In normal electric scooter, the head lamps are used in night time and user might forget to switch it off which will result in extra use of battery in day time. So we are using LDR (Light Dependent Resistor) in our EV to avoid unnecessary use of battery energy. LDR is the light sensing electronic device used to sense light. Whose resistance is depend on light intensity.

This system consist following parts:

A. LDR

There are different types of light sensors available, but for better efficiency of the system, LDR (Light Dependent Resistor) is used as sensor light switch in this light activated switch kit. The LDR sensor has some special features as it changes its resistance with the change in the daylight intensity. LDR is rugged in nature, hence can be used even in dirty and rough external environments like outdoor lighting of homes and in automatic street lights as well.

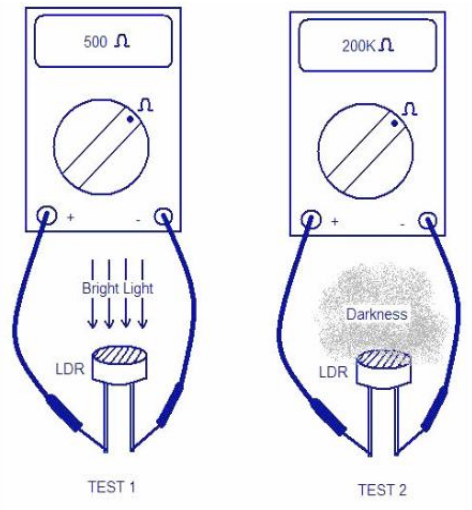

Fig.4:- LDR Resistance Variation with Light

Light Dependent Resistor or photo resistor or photocell is a variable resistor controlled by light intensity. It is made of high resistance semiconductor material like Cadmium Sulphide that exhibits photoconductivity. In dark, the LDR has very high resistance of around a few MΩ (Mega Ohms) and in the light, its resistance decreases to around a few 100Ω (hundred Ohms). Hence, its resistance is inversely proportional to the light intensity.

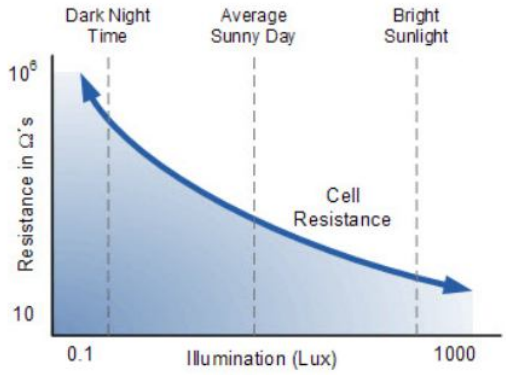

Fig.5:- Illumination Vs Resistance of LDR

As shown in the above figure, the LDR consists of a wave-shaped design on the top surface of it with two terminals similar to a general resistor, and the graph represents the inverse proportionality of the LDR with the light intensity.

B. Darlington Pair

Instead of a single transistor, a back-to-back connection of two transistors is used in a circuit which is termed as Darlington pair; this can also be considered as a single transistor with a very high current gained compared to general transistor. The input to the load given through a Darlington pair can be derived as a product of the input current and gain of the transistor. We know that, for switching on a transistor, the base voltage must be greater than 0.7v – but, for a Darlington pair, this base voltage must be 1.4v as there are two transistors need to be switched on.

C. Relay

A relay plays a vital role in the main circuit for activating the head lamp of electric scooter. The relay consists of a coil which gets energized if it gets enough supply depending on the rating of the relay.

IV. METHODOLOGY OF AUTOMATIC HEADLAMP ON/OFF SYSTEM

The components used for this system are as follows:

1. LDR
2. Transistor BC547
3. Relay
4. Resistor (100/330/1000 ohm)

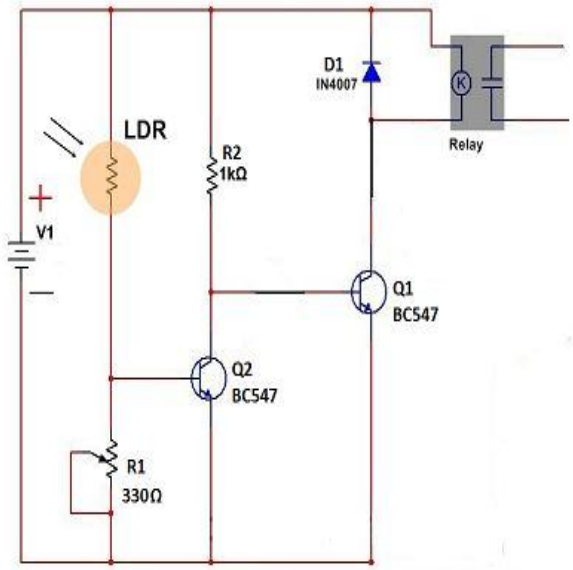

Fig.5:- Circuit Diagram of Automatic Light ON-OFF System Using LDR

During the day time, the LDR has very-low resistance of around a few 100Ω, and then the entire supply is passed through the LDR and gets grounded through the resistor and variable resistor as shown in the circuit. This is due to the fact that the resistance offered by the LDR is less compared to the remaining path (Relay and Darlington pair) of the circuit. As we know that the principle current always chooses the low resistance path to flow. Hence, the relay coil does not get energized as it has not got enough supply. Thus, the load remains switched off during the daylight.

Similarly, during the night time (when the daylight intensity is very less), the LDR resistance becomes very high: around a few Mega ohms (approximately 20MΩ). Thus LDR offers a very-high resistance (almost an open circuit type), and hence, opposes the flow of current. Again, according to the principle of current, by choosing low-resistance path, no current flows through the LDR, and thus, the current chooses an alternate path to flow such that it causes the Darlington pair base voltage to increase more than 1.4v. Thus, the Darlington pair gets activated, and then the relay coil gets energized, and thus, turns the load to switch on.

Thus, if the intensity of the daylight falling on the LDR of the light-activated switch is high (during the day time/morning time), then the load will be turned off – and, if the intensity of day light is low (during the night time), the load will be turned on.

V. RESULT AND CONCLUSION

The combination of biometric fingerprint system and numeric keypad enhances the security of a vehicle and makes it possible only for some selected people to start the vehicle. By entering correct PIN or scanning appropriate finger, the vehicle can start. Thus by implementing this relatively cheap and easily available system on a vehicle one can ensure much greater security and exclusivity than that offered by a conventional lock and key. The thief would have to do a great deal of homework to steal the vehicle, and it is unlikely that they have enough knowledge of the fingerprint technology needed to make fake fingerprint.

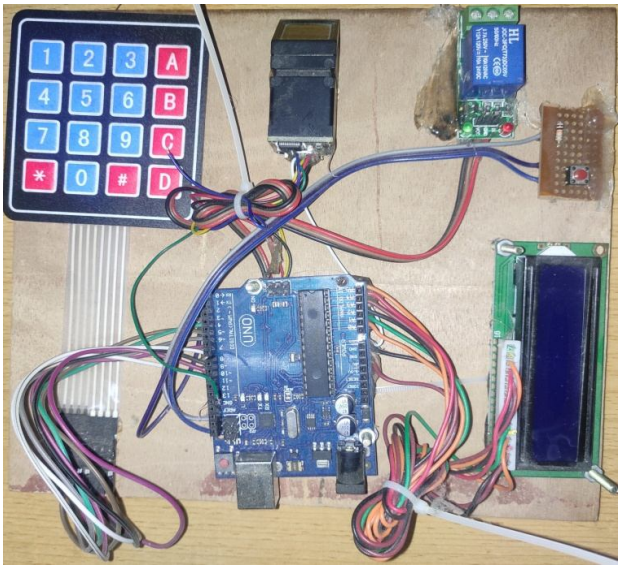

Fig.6:- Experimental Setup of EV Starting system

The proposed automatic headlamp on off system using LDR sensor used in EV helps to decide whether headlamp kept on or not. During daytime, sufficient light detected by sensor which will turn-off the headlamp automatically. Especially during night time, sensor detects insufficient light and it will turn on headlamp. While running on street, when EV will come below street lamp, headlamp will automatically turn off and once EV leaves that place, headlamp will turn on automatically which will save in EV battery power even in night time.

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