SOLAR BASED SMART VEHICLE

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Abstract: Developing countries like India, Pakistan and Bangladesh etc. are facing severe energy and economic crises. The use and awareness of renewable energy system is strongly recommended for economic evolution of these countries. Moreover, they are also facing the problem of dreadful shortage of natural fuel (petrol, diesel and CNG). In order to combat this, our aim is to design a vehicle that could make efficient use of renewable energy source e.g. (the solar energy) as a replacement of natural fuels. Today in the current global scenario safety and especially security of vehicle in common parking places has become a prime concern. In this system simple and cheaper vehicle tracking is implemented with the help of Global Positioning System (GPS), and Global System for Mobile Communication (GSM) technologies. The main components in the system are GPS module, GSM modem, IR sensor and microcontroller. The use of GPS system is to track the current location of the vehicle. As GPS system can only receive the vehicle location information from the satellites, GSM system is also installed in the vehicle for sending information to vehicle's owner. In case of breakdown of vehicle, this system automatically sends the SMS to own.

Keyword– Solar Panel, Fingerprint module, GSM module, GPS Module, Safe Solar Vehicle

I. INTRODUCTION

For a developing country like India which imports natural fuel, the ever growing demand of fuel is a burden to its economy. Solar vehicles can prove valuable in decreasing usage of fuel. The conventional model consists of drive system powered by a battery which is charged through a solar array. The drive system consists of three main components such as motor, controller and the drive shaft. By considering the conventional model, very less importance is given towards the safety of the driver and monitoring the performance of the vehicle. The conventional solar vehicle is designed merely as a simple mode of transport. It ensures limited safety and comfort to the driver which forms the disadvantages.

II. LITERATURE REVIEW

The following research articles are selected for review:

In 2003, Alaqeeli, J. Starzyk and F.V. Graas, published their results in Proceedings, International Symposium on Circuits and Systems, IEEE Xplore Press. The authors had designed a novel signal acquisition and tracking method that reduces the number of operations, simplifies hardware implementation and decreases the acquisition time. Speeding up the GPS block processing was the goal of this paper [1].

In 1997, R. Borchers and Locker, published their results in Electrical Insulation and Electrical Manufacturing and Coil Winding. Through their model, the authors tried to depict the scenario relating to the feasibility of the solar vehicle on small commercial level, extracting power from solar panel, replacement of IC engine by dc motor, control of motor via dc drive and various other supporting features have been added as the part of this vehicle which can be considered as cost effective (manufacturing) [2].

In 2012, M. Abuzalata, M. Momani, S. Fayyad and S. Abu published their results in Science Publications. The authors have presented a new design for an anti-theft protection system as an inexpensive solution to protect cars from theft and from non-authorized users by using microcontroller-based system [3].

In 2017, Sushanth K J, A. Farana, Sachin, B. Salina, M. Isthikar published their work in International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering. The authors present a simple and cheaper vehicle tracking system with the help of Global Positioning System (GPS), and Global System for Mobile

Communication (GSM) technologies. The main components in the system are GPS module, GSM modem, IR sensor, RFID reader and microcontroller.

In 2014, T. M. A. Khan, S. Rahman, M. K. Afghani, K. E. Fahim, published their work in Department of Electrical and Electronics Engineering BRAC University, Dhaka, Bangladesh. The paper looks into how the car is developed, battery modeling to figure out the discharging characteristics and results from charging the batteries using solar panels. The paper also looks into experiments done on electromagnetic interferences that affect any devices in the car.

III. PROPOSED SYSTEM

- The block diagram as shown in Figure below portrays the proposed model of solar based smart vehicle that incorporates various sophisticated safety features and vehicle monitoring system.
- Arduino Mega is used as a micro-controller which is the heart of the entire project, to which all the components are connected.

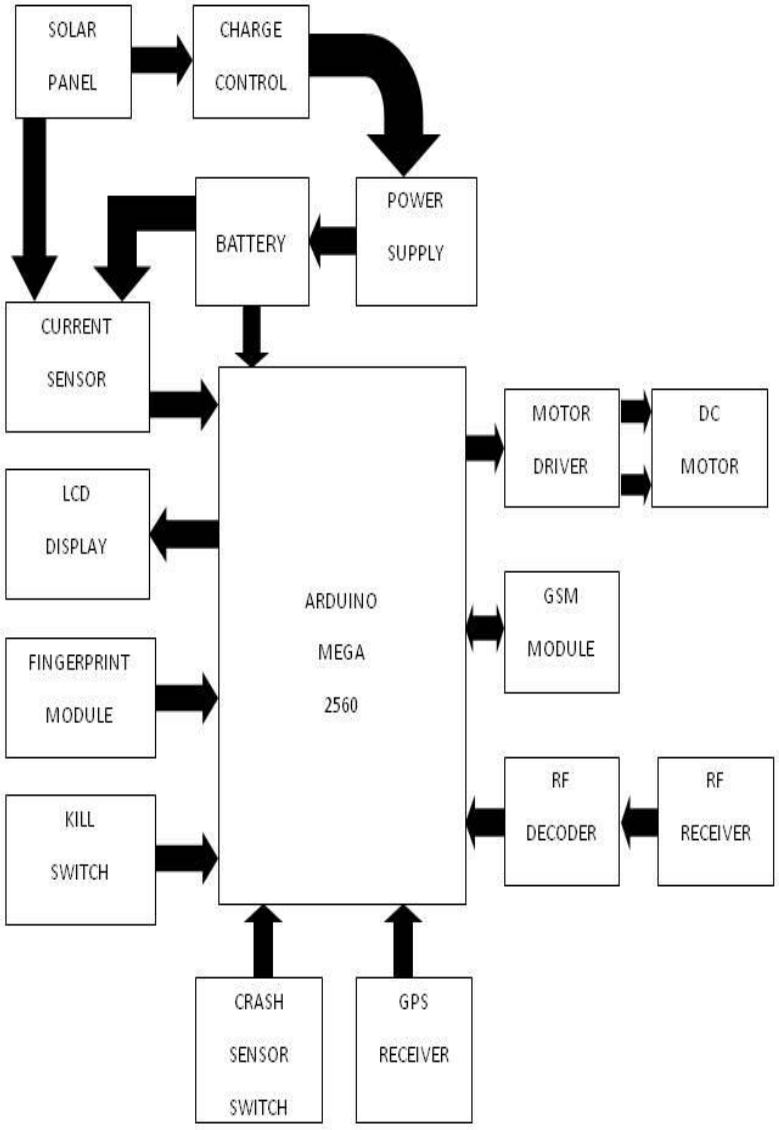

Fig. Block Diagram

- The solar panel gets sunlight and converts it to electric energy which is stored in the battery. The battery charges from solar panel with the help of a charge controller circuit. The advantage of charge circuit is that it prevents excess uncontrolled energy to enter the circuit as well as to avoid the backward flow of current.

- The vehicle starts with the fingerprint authentication of the driver, which is displayed on the LCD. If the fingerprint does not match the registered fingerprint stored in the memory, then the vehicle does not start. This acts as a safety feature to prevent vehicle theft.
- GSM and GPS modules also provide safety features. In case of accident conditions, the crash sensor switch is pressed which alerts the Arduino which in return alerts the GSM and GPS module. At this moment an accident alert message is sent to the registered mobile number. The kill switch serves as an instant alarm to stop the motors and the vehicle. Current sensor ACS712 measures the current flowing in the circuit at regular intervals.

IV. FLOW CHART

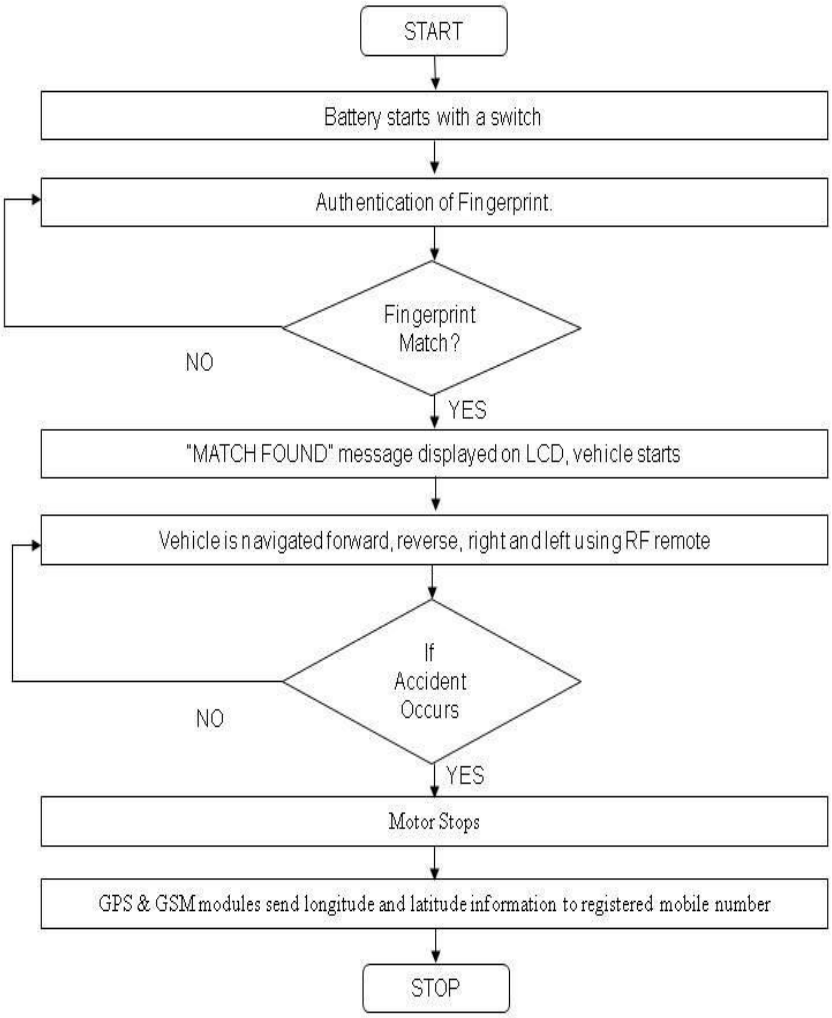

Fig. Flow Chart

- Battery is started using a switch which supplies power to the fingerprint module and other components.
- Instead of a key, a fingerprint sensor is used to start the vehicle. The fingerprint sensor authenticates the driver's fingerprints. The vehicle starts only if the fingerprint matches to the fingerprint in the memory. If the fingerprint does not match, a "MATCH NOT FOUND" message is displayed on the LCD. This acts as a safety feature to prevent theft of the vehicle.
- In this prototype, an RF remote is used to control the vehicle. The vehicle is controlled by the usage of four push buttons, one for each direction. It consists of RF transmitter which transmits the signals to the RF receiver placed on the vehicle.

- Current sensor ACS712 measures the current flowing in the circuit at regular intervals.
- In case of accident, the crash sensor switch is pressed. This instantly stops the motors and an emergency alert message is sent to the emergency contact number saved in the memory. This is achieved using GSM and GPS modules. This acts as a safety feature.
- Kill switch comes into picture when vehicle seems to be out of control. Use of this switch will stop the motors immediately preventing accident conditions.

V. METHODOLOGY

Charging Circuit:

- The charging circuit as shown in figure 4.1 consists of transistors, IC 7812, optocoupler, Zener diode, regulators with heat sink, LEDs, resistors and capacitors.
- It is used for charging battery from solar panel.
- The regulated out voltages is given to the battery. There is also a trickle charge mode circuitry which will help to reduce the current when the battery is fully charged.
- It has three indicators which indicate:
  - LED 1: Motor is working on battery
  - LED 2: Battery charge is low
  - LED 3: Battery is charging on solar
  -

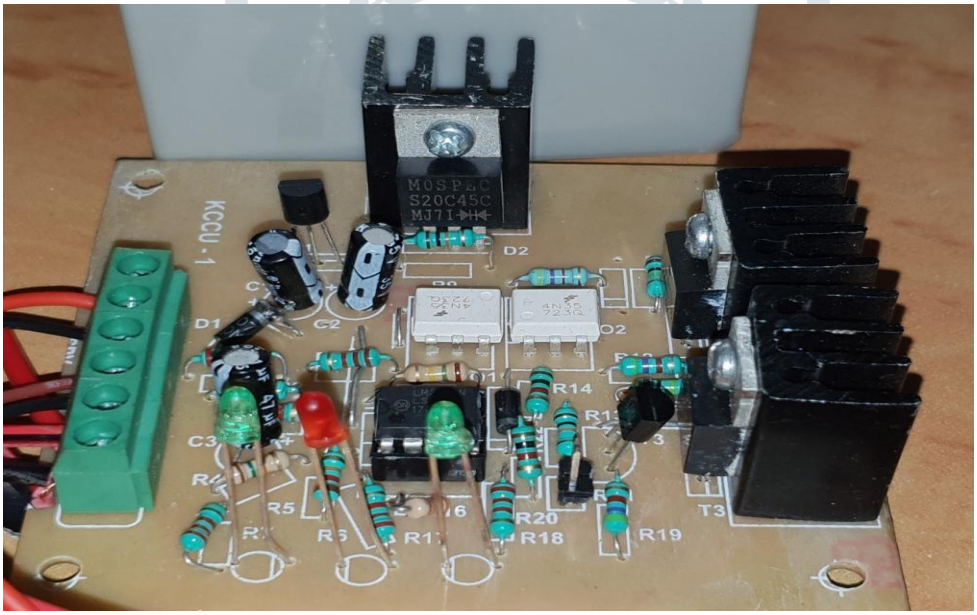

Fig. Charging Circuit

Kill Switch:

- The kill switch is used for safety purpose.
- It is designed to shut down the motor as quickly as possible during accidents or other dangerous scenarios when the motor needs to be turned off immediately, to avoid damage to its machinery, appliances or collisions.

Crash Sensor Switch:

- When an accident occurs the crash sensor switch gets triggered and it sends an interrupt to the Arduino Mega.
- Arduino Mega receives interrupt and runs the interrupt program which activates the GSM and GPS module which sends the location to the Emergency Contact.

Remote Control:

- The remote control as shown in figure 6 is a wireless remote used to navigate the vehicle.
- It consists of an ON/OFF button, four buttons to move the vehicle in forward, reverse, right and left direction.
- It also consists of RF transmitter which transmits the signals to the RF receiver placed on the vehicle.

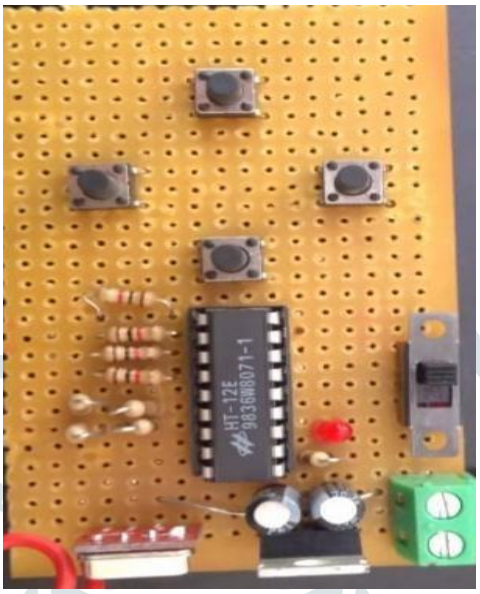

Fig. Remote Control

VI. RESULT:

The vehicle shown in figure below starts with authenticating the fingerprint of the driver. The model is controlled using an RF Remote. If the vehicle goes out of control, kill switch is pressed and vehicle stops immediately. Crash sensor switch is pressed when in accident which instantly stops the vehicle and emergency contact number is alerted.

The designed Solar Based Smart Vehicle uses GPS and GSM modules to alert an emergency contact about the accident occurred along with the co-ordinates on the accident. Figure shows screenshot of the alert message received on the emergency number. The message contains Latitude and Longitude of the place where accident occurred. ACS712 current sensor measures the current flowing in the circuit in Ampere. Figures above show voltage in (mV) and current in (A) measured by the sensor.

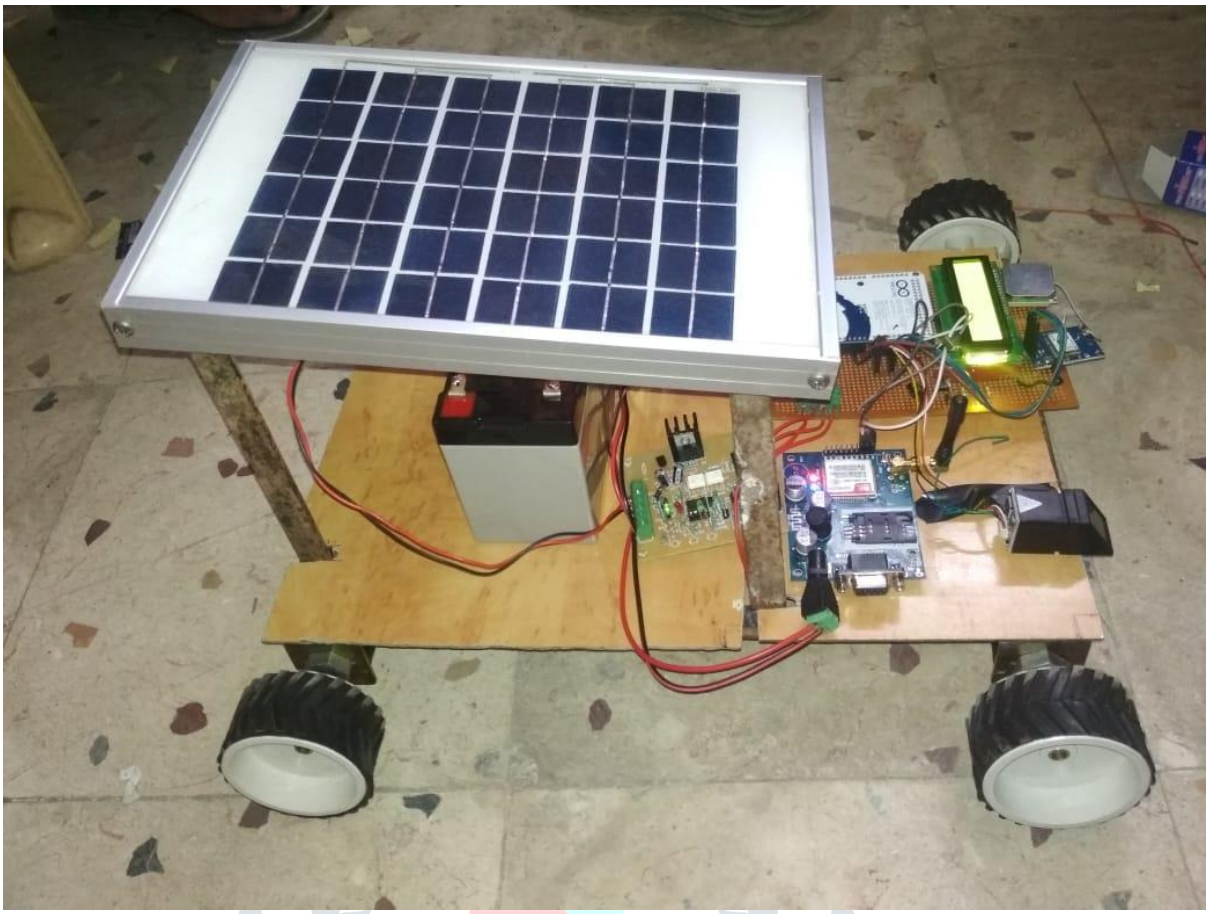

Fig. Solar Based Smart Vehicle

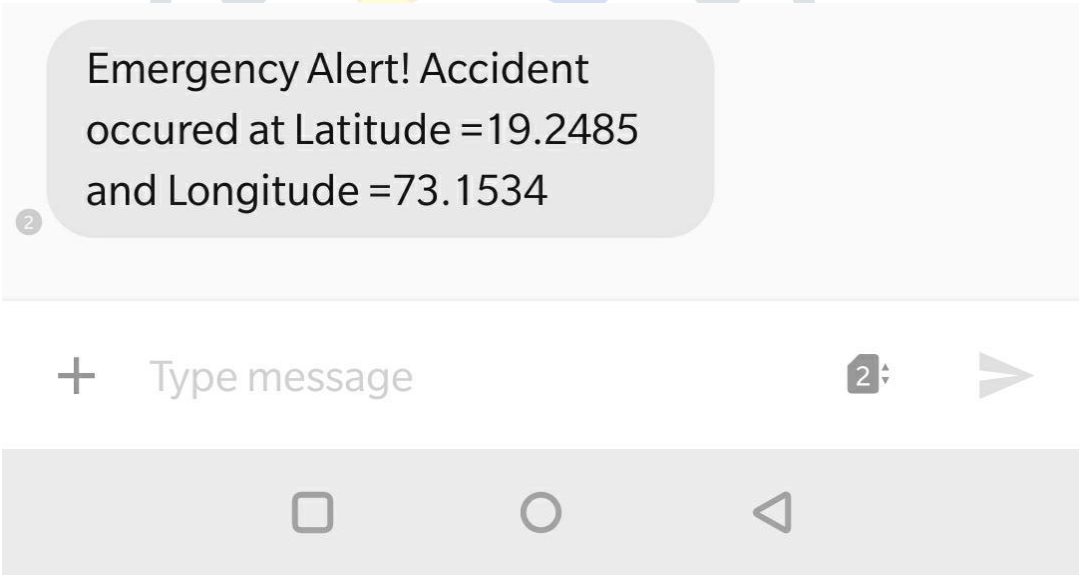

Fig. Accident Alert Message sent by GPS Module

Fig. Voltage (mV) and Current (A) reading of Solar Panel

Fig. Voltage (mV) and Current (A) reading of Battery

VII. IMPLEMENTATION:

Fig. Solar Based Smart Vehicle

VIII CONCLUSION:

The solar panel converts the solar power to electricity and charges the battery and it generates DC current to drive the motors and other parts of the vehicle.

The designed Solar Based Smart Vehicle is safe with no volatile fuel or hot exhaust systems. It is a zero emission vehicle, odorless, smokeless and noiseless. It requires minimum maintenance, is more reliable and can be efficiently charged almost anywhere. Needless to say it is very much cost efficient.

Fingerprint module successfully stores the biometric of the owner/drivers in its memory. When the vehicle starts, the owner's fingerprint is scanned and is verified and then allowed to drive. A 5W solar panel with a peak voltage of 16.4V and peak current of 305mA is used in this project. A battery of 12V 7.2AH is used to store the electricity generated by the solar panel. On impact or after an accident, the vehicle comes to stop and the GSM SIM900 module sends an emergency message to a number saved in its memory. The message contains location co-ordinates of the vehicle as given by the GPS Module. Current sensor measures the current flowing in the circuit at regular intervals.

IX. ACKNOWLEDGMENT:

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Under these responsible and talented personalities, we were efficiently able to complete our project in time.

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