Solar bag with Auto Tracking & Theft Alerting System

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***Abstract* : A Solar backpack is a cloth sack carried on one's back and secured with two straps that go over the shoulders, equipped with thin film solar cells and batteries.Microcontroller ATmega16, the brain of the proposed system will control all the distinguishable features. Solar panel attached on the front part of the bag will charge not only the electronic appliances like mobile phones, laptop, etc. but will also power the entire system. RF-ID Technology will be used to solve the problem of forgetfulness to pack the required items. The object to be placed inside the bag will have these RF-ID tags attached to them. These tags will then be read by the RF-ID reader. Another feature tackles the problem arising in the threatening situations. Emergency button present on the bag which when pressed will solve this problem in any emergency situation. When the button will be pressed, a buzzer will get activated and the location of the victim will be sent via SMS to three contacts and to the police control room as well. Another feature is an anti-theft feature which will track the mobile in case of any theft. Bluetooth Module will be used for tracking purpose.**

Keywords: Microcontroller ATmega16, RF-ID, Solar Panel, Bluetooth, GPS

I. INTRODUCTION

Now-a-days everybody uses a Smart Phone. From communication features to online shopping or ticket reservation, everything can be done using Smart Phones. However its frequent usage discharges the mobile battery more often. Also when these mobiles grow old, it is observed that the battery discharges frequently and requires charging in shortinterval. To overcome this problem many Smart Phone users buy power banks.But these power banks also have to be charged separately on daily basis. Substitute for this situation can be using an energy source which is abundantly and easily available and safe to use.

Best suitable for this requirement is Solar Energy. Large numbers of applications are emerging these days that employ solar energy. Solar Energy is one of the important renewable energy sources and its technologies can be broadly categorized as either passive solar or active solar based on the way they capture and distribute solar energy or the methods by which it converts it into solar power. Active solar techniques consist of the use of photovoltaic systems, concentrated solar power and solar water heating to harness the energy. Passive solar techniques include positioning a building to the Sun, picking materials with promising thermal mass or light dispersing properties, and designing spaces that naturally circulate air. India is heavily populated and has high solar isolation, an ideal blend for using solar power in India. Moreover, its other energy resources are relatively scarce. In the solar energy sector, some large projects have been proposed, and a 35,000 sq.km area of the Thar Desert has been set aside for solar power projects, sufficient to generate to 2100 GW 1. This paper also suggests a system that can be useful for forgetful people to some extent to overcome problem of remembering things to be carried along. This is achieved with the help of RF-ID reader and tags. RF-ID technology is one of the most speedily evolving technologies of 21st century providing enormous economic benefit for both business and consumers.

According to Thomas Reuters Foundation global poll, India is the “fourth most dangerous country” in the world for women2. This take places in a country where women make it to the top political and managerial positions. The proposed Smart Bag adds in a feature to offer security to women through an emergency button on the bag. When this button is pressed, the victim’s location will be traced using GPS of mobile, and a SMS will be sent to victim’s contacts. Mobile phone robberies and extraction of personal data has become a growing concern. Increase in cost of mobiles has also led to increase in the number of robberies of mobile phones.

Hence there is a need of a system which will indicate immediately that the theft is taking place and produce an alarm to scare the thief and also make surrounding people note of such incidence. This can be implemented using Bluetooth module which will be kept inside the bag. The Bluetooth module is paired with the Bluetooth of the mobile. If the connectivity between mobile and Bluetooth module is lost, an alarm system will be activated to indicate theft of mobile. The mobile can be retrieved by getting its location with the help of other person’s phone.

II. SOLAR BAG PACK

2.1. Block diagram

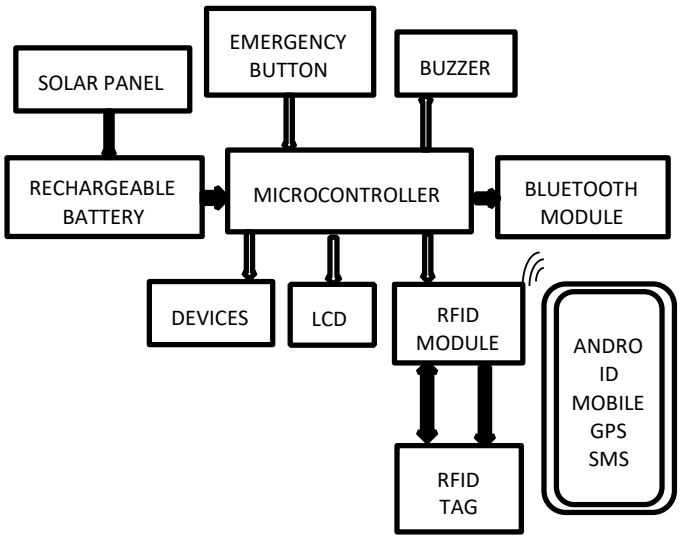

Fig.1 block diagram of solar bag system

2.2.Proposed System

Solar panel that will be attached on front part of the bag was decided to be of 12 Volt, 5 Watt. The charge from solar panel is temporarily stored in a lead acid rechargeable battery of 12 Volts. This voltage is converted to 5 Volts using voltage regulator 7805. The battery powers the microcontroller and other circuitry and also provides charging to the electronic devices.

The RF-ID tags are attached to regularly needed items. RF-ID Reader having an operating frequency of 125 KHz is used to read the tags. The reader reads the tag, serially transmitting data to microcontroller. The missing item is then displayed on LCD for indication to the user.

A Bluetooth Module HC05 with operating frequency of 2.4 GHz is used to detect the connectivity between mobile and bag. The Microcontroller receives information from both Bluetooth module and RF-ID Reader.

When the emergency button that will be on handle of bag is pressed by the victim, Microcontroller is triggered activating the buzzer. Bluetooth module that is serially interfaced with microcontroller does wireless communication with mobile phone to get the location of victim using GPS of mobile and send SMS to emergency contacts.

III. HARDWARE REQUIREMENT

3.1. Microcontroller

A microcontroller is a small computer integrated on a single chip and consisting of a processor core, memory, and programmable input/output peripherals. ATmega16 is a high-performance; low-power Atmel 8-bit AVR RISC-based microcontroller. RISC (Reduced Instruction Set Computing) means it has simplified instruction set and most of the instructions can be executed in one machine cycle. It has 16KB of programmable flash memory, 1KB SRAM, 512 Bytes EEPROM, a JTAG interface meant for on-chip debugging and an 8-channel in-built 10-bit A/D converter so that the need to interface ADC externally to ATmega16 is eliminated. The device operates between 4.5-5.5 Volts. It supports throughput of 16 MIPS at 16 MHz. By executing instructions in a single clock cycle, the device achieves throughputs approaching 1 MIPS per MHz hence it balances power consumption and processing speed.

3.2.Solar panel

Solar panel has one or more solar photovoltaic (PV) modules that are connected electrically to each other .They are mounted on a supportive structure. Thin-film solar panels are suitable for single-device applications, like recharging a battery-operated device or to power a specific appliance[10]. Photovoltaic or PV technology uses solar cells or solar photovoltaic arrays for converting energy from the sun into electricity. Solar cells produce direct current electricity from the sun's rays, which can then be used to power equipment or to recharge batteries. Each module has rating in terms of its DC output power under standard test conditions, and typically ranges from 100 to 320 Watts.

3.3. Bluetooth Module

Bluetooth is a wireless technology standard. Bluetooth Module is a device that acts as a mediator between embedded system and the Bluetooth communication device. It has UART (Universal Asynchronous receiver and Transmitter) interface for handling serial communication between the transmitter and receiver. Data can be exchanged over short distances (using short-wavelength UHF radio waves in the ISM band from 2.4 to 2.485 GHz). It is a low-power consumption device, with a short range of about 10 meters. Low-cost transceiver microchips are present in each device. Bluetooth device being a radio communication device do not require a line of sight of each other.

3.4. RF-ID Module

RF-ID, or Radio Frequency IDentification, is a data collection method that utilizes low power radio waves to send and receive data between tags and readers. The advantage of RF-ID is that direct contact

or line-of-sight scanning is not required. An RF-ID system consists of three components: an antenna and transceiver (often combined into one reader) and a transponder (the tag). The antenna uses radio frequency waves to transmit a signal that activating the transponder[11]. When activated, the tag transmits data back to the antenna. The data is used to notify a programmable logic controller that an action should occur. RF-ID uses a reader to read special RF-ID tags attached to a specific item.

3.5. RF-ID Tags

RF-ID tags have an inbuilt antenna that generates a magnetic field for communication between RF-ID Reader and Tag. RF-ID tags are usually of two types: Active tag and Passive Tag. Active RF-ID and Passive RF-ID are basically distinct technologies but often evaluated together. Radio frequency energy is used for communication between both types of tag and the reader but the method of powering the tags is different. Passive RF-ID bank on RF energy which is transferred from the reader to the tag. Hence stronger signals are required from the passive reader. The signal strength returned from the tag is constrained to very low levels[12].Passive Clamshell card that are of low cost and credit card shape have been chosen to be used in the system.

3.6. Battery

Lead-acid batteries has low initial cost and they are readily available nearly everywhere. Hence they are the most common choice in PV systems. They are available in different sizes and different designs, but the most important designation is whether they are deep cycle batteries or shallow cycle batteries. Car batteries are shallow cycle batteries, giving large amounts of power to start the engine. There are two main type of deep cycle lead acid battery:

Both the types of deep-cycle lead acid batteries are maintenance Free. Lead acid batteries are measured in AH or amp hours. In general, they range from 1ah to 300ah. These batteries are used in applications like emergency lamp, solar mini system and miscellaneous mini-projects[13].

IV. SOFTWARE REQUIREMENTS

4.1. bascom avr

Apart from the hardware design requirements we need to use software for writing separate routines for different interfacing devices and testing them on the designed hardware. The program is written in basic programming language and compiled using BASCOM AVR. It is a flexible and easy-to-use Windows Basic compiler and IDE for AVR family.

V. IMPLEMENTATION

5.1. PCB Design and Etching

Printed circuit boards (PCBs), are specially made for each circuit. These are not only compact but also cheaper than the already available ready-made modules or boards. There are many software applications available on the Internet that are used to draw the schematic of the circuit. ExpressSCH has been used for drawing the schematic. ExpressPCB including ExpressSCH is open-source software.

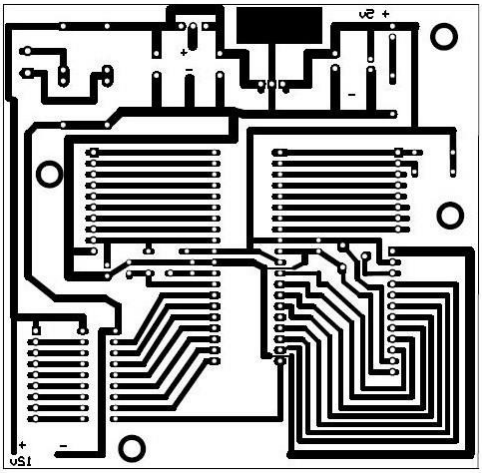

Fig.2 eample of PCB design

The above schematic is of self-designed development board for ATmega16

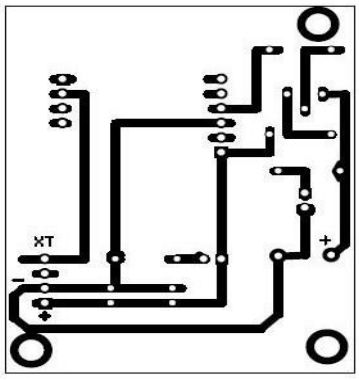

Fig.3 example of RF-ID circuit

The above designed RF-ID TTL circuit has an on-board power indication LED, another LED and Buzzer which together point out the presence of RF-ID Card. RF-ID cards in the range of 8-10cm are detected. The EM18 reader will read the 12-digit

unique ID of the Tag and transmit it as ASCII characters through the serial output with 9600 bits per second. The circuit includes a buzzer that beeps when a Tag is read successfully. The board is powered by 5 V and it requires a direct connection to the Microcontroller's Serial Rx pin. The card data is transmitted serially when the card is brought near the module.

5.2. Results obtained

Fig.4 model of solar bag system.

The development board PCB and RF-ID module PCB are etched and components are soldered. Solar panel is connected to lead acid Battery and ON/OFF switch is fixed on the battery. On making the switch ON, power indication LED on Development board and Reader Module glows indicating proper working of the circuit. "Smart Bag" is displayed on LCD. When any of the RF-ID tags are close to Reader, they are detected and their unique identification number is displayed on LCD. There is a beep sound and LED indication when the tag is read.

VI. CONCLUSION

New inventions in Science and Technology have been increasing tremendously. This solar energy based Smart Bag is very easy to use and provides day-to-day required features. This bag is less complicated and compact which can be used for handling difficult tasks. This bag being user-friendly people of any age group can use it according to their requirements. The paper basically highlights two features of the proposed system. The most vital feature of this idea has been implemented, powering the entire circuitry and charging of mobile phones through solar energy using the solar panel. Another feature, which is currently being worked on is to read the RF-ID tags by RF-ID reader using RFID technology. These two features solve the problem of forgetfulness and quick draining down of the batteries. With the help of new emerging technologies, the weight of the circuitry in the bag can be decreased.

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