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Solar Powered IoT based Intelligent Sanitary Napkin Dispenser

K. Samba Siva Rao[1], K. Harish[2] M. Kavin Kumar [3], D. Vishnu Harish[4]
[1]*Assistant Professor, EIE Department, SNS College of Technology*
[2, 3 & 4] *UG Scholars, EIE Department, SNS College of Technology*

Abstract: ***Women hygiene is of utmost importance and is to be taken care of. Women in India are still shy of buying napkins from medical shops and other stores. A solution to this problem is installing napkin dispensing system in schools, colleges and public places. The main drawback of the existing coin operated dispensing system is that there is no mechanism available for the person refilling the napkins to know about the status of napkins available in the system. So, a person has to regularly check the availability of napkins in the system manually and refill it. This work aims at installing an automatic napkin dispenser in toilets and places that can keep track of available napkins and inform the person concerned when fewer napkins are available.***
Keywords: Sanitary Napkin, Dispenser, PLC, RFID, Solar Panel.

I. INTRODUCTION

According to a survey 23% of adolescent girls drop out of school since proper facilities are not provided to them when they are menstruating [12]. In schools, girls don't have access to functional toilets, access to clean water and proper sanitation and disposable facilities [13]. During the first three days of menstruation they need to change their sanitary napkins every three to four hours else they will be easily getting affected by uterus Cancer and Toxic Shock Syndrome (TSS). TSS can affect anyone who uses the tampons for long time [10]. So there is a need to make the sanitary napkins easily available to them, which can be achieved by vending machines. Napkin Vending Machine is a personal hygiene product for women. It allows immediate access to napkins anytime of the day to meet menstrual emergencies. It also saves women from embarrassment faced while buying napkins at the shop. By installing vending machines in the working area and educational institutions, it would help them to get the napkins as and when required.

II. EXISTING SYSTEM

The existing napkin dispenser is operated by the coin mechanism. The main drawback of the existing system is that there is no mechanism available for the person refilling the napkins to know about the status of napkins available in the system. So, a person has to regularly check the availability of napkins in the system manually and refill it. Another major drawback is that the coins can be duplicated or operated in a fashion such that napkin can be obtained without coin.

III. PROPOSED SYSTEM

This work aims to develop an IoT based intelligent sanitary napkin vending machine. It is controlled by a PLC. The napkin dispenser is designed to work with both coins and a RFID card. As the user drops the coin or swipes the RFID card, the coin acceptor or the RFID reader detects the coin or card and the PLC sends signal to turn on a relay. The relay in turn switches on a motor, which rotates the spring coil to dispense a fresh napkin. The PLC keeps track of the available napkins in the machine and automatically sends a SMS to the mobile of the concerned person responsible for refilling the napkins.

The Block schematic of Napkin Dispenser is as shown in fig.1.

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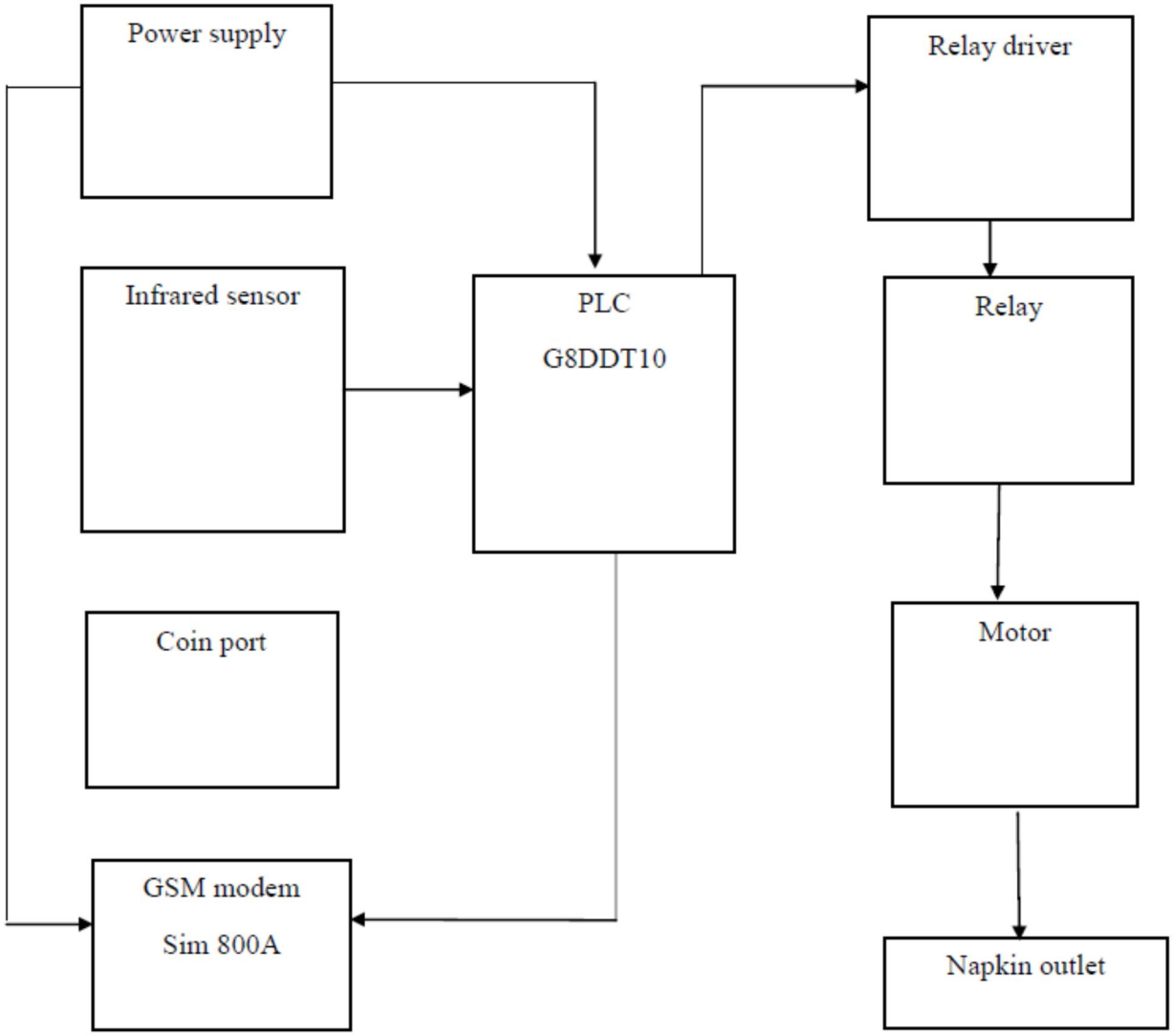

Fig.1. Napkin Dispenser Block Schematic

A. Battery

The battery is used to supply electric power to the PLC, GSM Modem and relay. The battery can also be charged via the solar panel and can supply power to the devices. This work uses a 12 V rechargeable battery. The battery used is shown in fig.2.

Fig.2 Battery

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B. IR Sensor & RFID Reader

An infrared sensor is an electronic device that emits IR rays in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detect the motion. The sensors that only measure IR radiation and do not emit radiation are passive IR sensor. Usually in the infrared spectrum, all the objects radiate some form of thermal radiations. These types of radiations are invisible to our eyes. IR sensor consists of an IR transmitter and IR receiver. The emitter is simply an IR LED and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, the resistances and their output voltage change in proportion to the magnitude of the IR light received.

In this work, IR sensor has been used to detect the dropping of coin by the user. When no coin is put at the entrance of the coin port, the IR rays from the emitter reach the IR receiver and no action is taken by the system. But once the coin is put at the entrance of coin acceptor, it blocks the IR rays from reaching the receiver, and this sends a signal to the PLC, which in turn switches on a relay.

RFID reader is used to detect the RFID card. When the user requiring Sanitary napkin waves the RFID card, the reader detects the card and initiates action to dispense the napkin.

C. PLC

PLCs (programmable logic controllers) are the control hubs for a wide variety of automated systems and processes. They contain multiple inputs and outputs that use transistors and other circuitry to simulate switches and relays to control equipment. PLC is the heart of this proposed work, which controls and automates the napkin dispenser.

Genie Nx Base Module PLC is used in this system. It has Backlit LCD Screen and 8 digital inputs, supports up to 48 I/Os (32 digital inputs and 16 digital outputs). It can accept up to 250 lines of ladder programming. Its features include PC software for programming, online and offline simulation, documentation and printing and it can generate 16 soft text messages, time switches, compare counters, timers and counters. It is designed for use in automation for commercial and industrial sectors.

The PLC used in this work is shown in fig.3.

Fig.3. Genie Nx Base Module PLC

In this work, the roles of PLC are:

1) Based on signal from IR sensor, it activates a relay to start the burning process.

2) Based on preset time, sends a signal to relay to turn off the burner (power saving mode)

D. Relay

It is an electromagnetic device used to isolate two circuits electrically and connect them magnetically. They are very useful devices and allow one circuit to switch another one while they are completely separate. They are often used to interface an electronic circuit (working at a low voltage) to an electrical circuit which works at very high voltage. For example, a relay can make a 5V DC battery circuit to switch a 230V AC mains circuit. Thus a small sensor circuit can drive, say, a fan or an electric bulb.

A relay switch can be divided into two parts: input and output. The input section has a coil which generates magnetic field when a small voltage from an electronic circuit is applied to it. This voltage is called the operating voltage. Commonly used relays are available in different configuration of operating voltages like 6V, 9V, 12V, 24V etc. The output section consists of contactors

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which connect or disconnect mechanically. In a basic relay there are three contactors: normally open (NO), normally closed (NC) and common (COM). At no input state, the COM is connected to NC. When the operating voltage is applied, the relay coil gets energized and the COM changes contact to NO. Different relay configurations are available like SPST, SPDT, DPDT etc., which have different number of changeover contacts. By using proper combination of contactors, the electrical circuit can be switched on and off. Relay is used to control the coil by heating them when it is turned ON and cooling down the coil by turn OFF.

Two 12V Relays have been used in this work. One relay is used to switch on the motor, which in turn rotates the spring mechanism. Another relay is used to switch on the PLC.

E. Spring Mechanism

Vending device for vending machine comprises of a spiral coil connected to a coin-operated mechanism/RFID based system, that allows rotation thereof and the connected coil when predetermined coins have been inserted into the mechanism as shown in fig.5. The loops making up the coil comprise closely spaced neighboring loops, remote from the mechanism, capable of supporting and transporting product to be vended as the coil is rotated, and distantly spaced neighboring loops, incapable of supporting the product. As the coil is turned, product is transported toward the mechanism until it reaches the distantly spaced loops where it drops from the spiral into a chute accessible by the purchaser. The mechanism is rotated by coin receivers that are blocked from rotating by spring-urged pawls unless predetermined coins have been inserted therein, or unless disabling tabs are interposed between the receivers and the pawls.

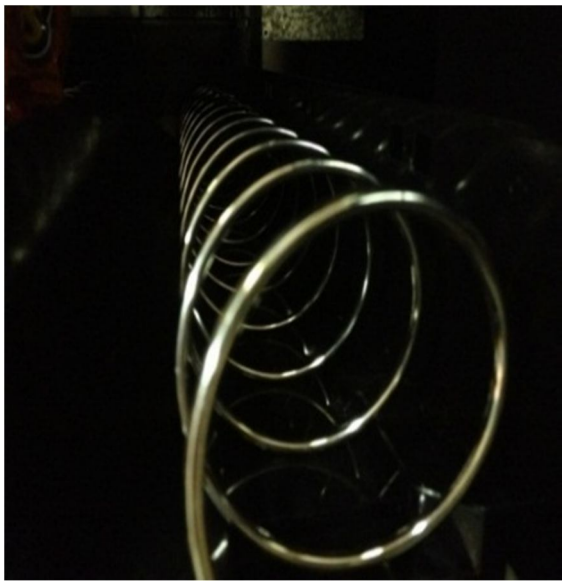

Fig.4 Spring mechanism

IV. IMPLEMENTATION

When the user inserts a coin or swipes a RFID card, the IR sensor or the RFID reader detects it and sends a signal to PLC. The PLC switches on the relay, which in turn switches on the motor. As the motor rotates the spring mechanism starts to rotate for a preset amount of time, during which the napkin is dispensed. Once a napkin is dispensed, the count of napkins available is updated in the PLC. As the count reaches a preset value, the PLC initiates sending a SMS via a GSM module.

The fabricated vending machine is shown in fig.5. The internal view is shown in fig.6. The material used for vending machine is mild steel with the thickness of 1.5 mm. The Dimensions of vending machine fabricated are:

A. Height: 50 cm
B. Width: 16 cm
C. Length: 52 cm
D. Spring length: 31 cm

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Fig.5 Napkin Vending machine

Fig.6 Internal View of vending machine

V. RESULTS

This system is basically built to vend sanitary napkins on dropping of coins and on swiping of RFID card. It was observed that the system was successful in this regard. When the count of napkins available in the system reached a value of three (preset count), a SMS was sent and received by a preset mobile number, the screenshot of which is shown in fig.7.

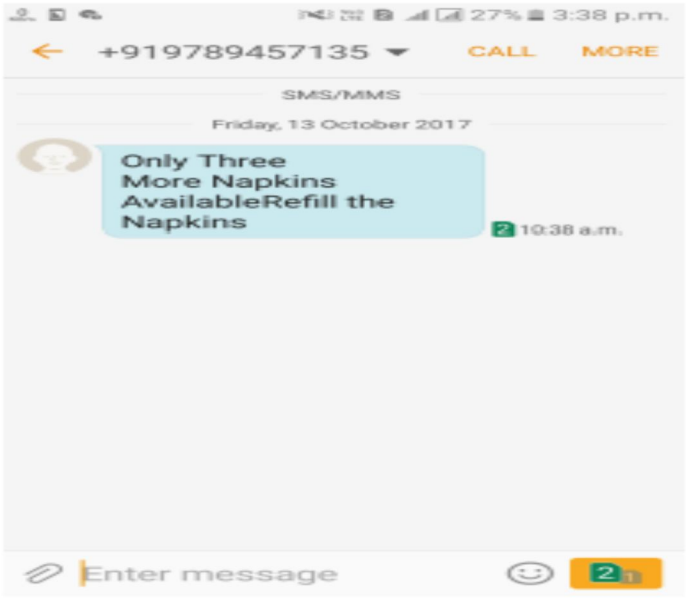

Fig.7 Screenshot of SMS

VI. CONCLUSION & FUTURE WORK

Women hygiene is of utmost importance and is to be taken care of. Women in India are still shy of buying napkins from medical shops and other stores. This issue has been addressed by fabricating a coin operated and RFID based Sanitary Napkin Dispenser. The system has the feature of intimating the person concerned through SMS for refilling the Napkins in the machine.

This system can be designed to load more napkins by using the rack and pinion method, so that frequent loading of napkins can be avoided. Napkin disposer too can be fabricated and integrated with the vending machine, so that dispensing and disposing can be achieved in a single unit.

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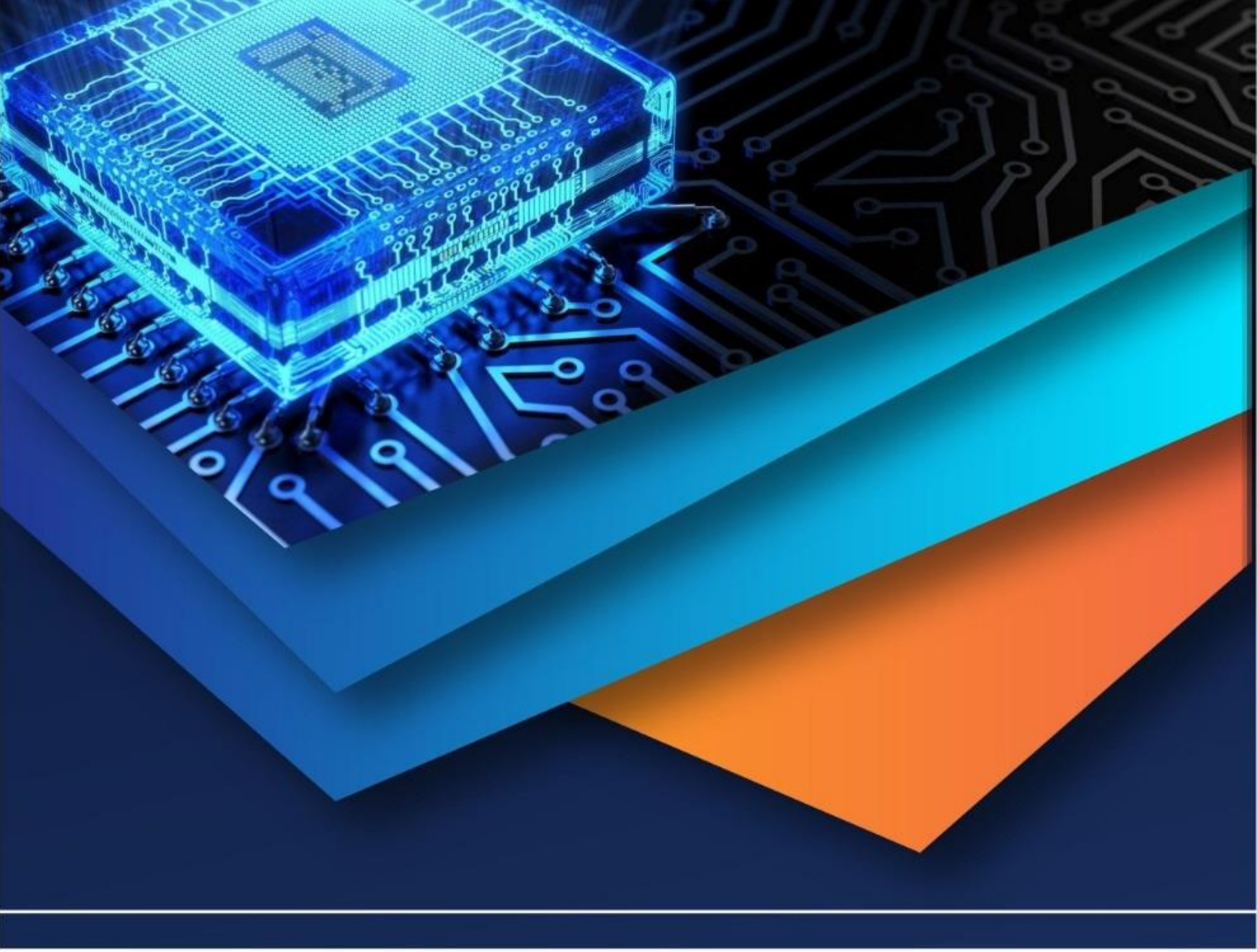

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