SMART VENDING MACHINE

TEAM- Robosapiens (Team ID-29)

TEAM MEMBERS-
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4. Sonal Kumar (Electrical Engineering)

LINK TO VIDEO OF THE WORKING MODEL:
https://www.youtube.com/watch?v=1HnIgZegNpE

LINK TO ABSTRACT OF OUR PROJECT:
**https://docs.google.com/document/d/13wWTvH1mbcLrdQYms88PPa_
Sxbd_1fGxb3wLUzIgnbo/edit?usp=sharing**

Idea for the project:
 The aim of our project is to reduce human labour and improve efficiency of service and accessibility.

Your motivation for the project: To make a smarter vending machine which would give 24*7 service to customers and to make maintenance of machine, more easier and smarter. Students need not to go too far from their room, and vendors could easily trust on this machines.

Plan of Action-

- **For implementing mechanical body/structure**

We designed a proper mechanical body, which would occupy minimum volume and will have light weight. Proper placement of motors and various other components is also targeted.

- **For Detecting any damage to machine like attempt to break glass/any great impulse/force applied to machine etc.**

We planned to use vibration sensor for this purpose, which would detect any damage to machine ranging from breaking of glass to detecting great impulse applied to machine.(After it crosses a particular threshold value).

- **For reporting products that are out of stock and damage report of machine to remote Vendor**

We decided to use a GSM module which would send sms to the remote vendor(Responsible person), informing about stock of items and damage report of machine, along with particular id of machine.

- **For coin detection**

We used image processing for the purpose of coin detection. Load cells were not easily available in high sensitivity.

TECHNICAL DETAILS

We used various modules in our project, here we are discussing some of their technical aspects of major components-

1. **Vibration Sensor**- We used Vibration sensor for detecting any damage to our model. Vibration sensors can be calibrated. We did the calibration of vibration sensor in such a way that some threshold vibration would detect that model is being damaged.
2. **Stepper Motors-** We used 2, 4.4Kg/cm Stepper motors for horizontal and vertical motion. We can observe motion in Video.
3. **GSM Module-** We used SIM800L gsm module for sending sms to authorized person. This module works only for **2G sim.**
4. **LCD Panel-** We used 16*2 LCD display for displaying commands on screen.
5. **Arduino Mega-** We used arduino mega for our project. It has more number of digital pins thus suitable for our product.
6. **Webcam**- We used a 4.8 megapixel camera for image processing.

ARDUINO CODE

Here is the link to our Arduino code-

https://docs.google.com/document/d/1TI0ulsikUrTzJSh_oophDM1aiV66w0 0G7Ho5pA1ZcM0/edit?usp=sharing

IMAGE PROCESSING

For the coin detection part, we used image processing using a webcam. We took advantage of coins having **different radius**, measuring their radius and determining their value.

We know that, this is not a reliable method, but for simplicity we implemented it. We did all computations in **python** and used "**Hough circle**" module for this purpose.Some of its clips are shown-
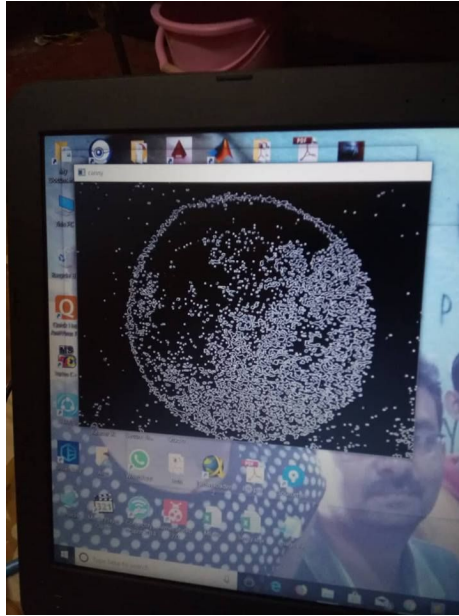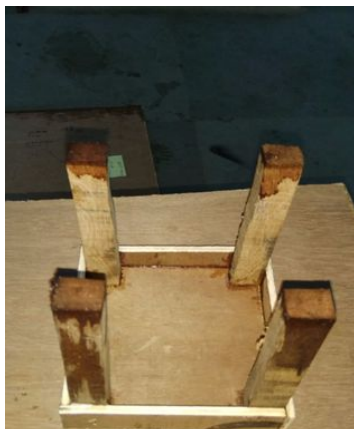
LINK TO OUR COIN DETECTION VIDEO:

https://youtu.be/tvqDEjfI6Vk

PROJECT DETAILS

- **TIMELINE (WORK UPDATES)-**

In the first week, we designed our basic mechanical structure. Before that, we designed our model on Autocad, including all dimensions.

Electrical Work was delayed as components arrived late.

We were to work only on Stepper motors.

In the 2nd week, we started working on Internal mechanical structures which include rails and container for motion. This was the most challenging structure as any mistake will prevent smooth motion of Container.

Side by Side, we were also working on electrical components, which mostly include testing of various components.

In 3rd week, we installed stepper motors, belt and pulleys. Some problems were coming in Vertical motion, which are discussed further.
In rest of weeks, we completed the electrical circuitry.
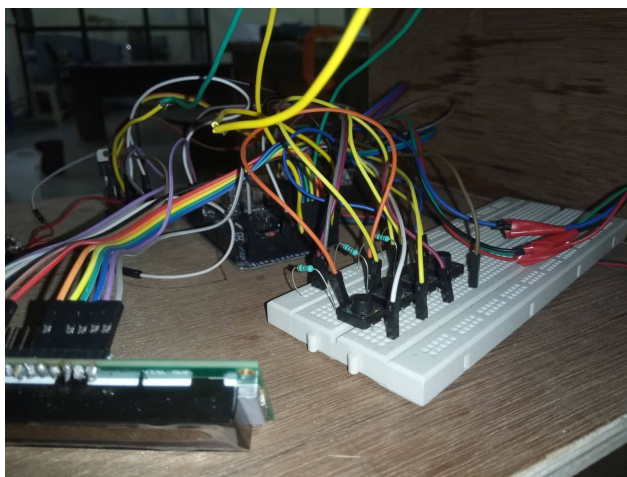
PROBLEMS FACED AND LESSONS LEARNT

- For vertical motion, we should have chosen stepper motor with more torque output as a torque of 4.4kg/cm **wasn't** sufficient for smooth motion, using a 12V AC-DC adapter.
- SIM800L module supports only 2G sims. Finding a 2G sim in this age is very difficult. Even many companies have **stopped** manufacturing it. So, we couldn't use that module. Yet we had an idea.
- The vibration sensor that are commercially available are too sensitive even after calibration(to the max). Thus, it quickly detects damage even if somebody strikes our model with medium force.
- We should have bought an adapter of min.**15V/4A** for smooth functioning of our model.

UTILITY OF PROJECT

Our another aim was to make this commodity as cheap as possible so that even common vendor could afford it. We added safety features to this so that vendors could easily rely and trust on this product.

These machines could be installed in **hostel corridors, tinkerer lab** in our institute, so that commodities can be made available to consumers in a more efficient and trustworthy manner. To make consumers, avail facilities for 24*7 hrs.

We provided power consumption feature , which will ensure saving of **considerable** amount of energy.

COMPONENTS USED

- Arduino Mega@1000/-
- Stepper Motor@950/- each
- Plywood@45/- per square feet(Total 1080/-)
- A4998 Stepper motor driver@150/- each

- LCD display panel(16*2)@200/-
- Web-cam@750/-
- Transistors-TL
- 12V/3A AC-DC adapter@400/-
- Vibration sensor@200/-
- SIM800L GSM module@500/-
- Miscellaneous@1000/-

<u>Smart Vending Machine</u>